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Participant Career and Research Outcomes of the Ralph E. Powe Junior Faculty Award

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To the Graduate Council:

I am submitting herewith a dissertation written by Samuel Held entitled "Participant Career and Research Outcomes of the Ralph E. Powe Junior Faculty Award." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Educational Psychology and Research.

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Participant Career and Research Outcomes of the Ralph E. Powe Junior Faculty Award

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Dedication

I dedicate this work to my family. My wife Erica who has given me unending support and strength to see this journey to its end. To my kids – Sam, Charlie, Tim, and Lila – you watched me grow through this journey as I watched you grow. I am so proud of you as I hope you are proud of me. Your love pushed me through to the end.

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I would like to thank most of all my wonderful family. My children – Sam, Charlie, Tim, and Lila – provided support and inspiration to me especially through the toughest times. I wanted you to learn that you can accomplish anything you set your mind to – anything! To my wife Erica, your support and understanding was infinite and always there. I cannot thank you enough especially for the occasional kick in the rear I needed. Without you, this would not have been possible at all.

Abstract

In 1991, ORAU created the Ralph E. Powe Junior Faculty Award program providing seed money for research of early career faculty at ORAU member universities. The Powe Awards are intended to enrich the research and professional growth of young faculty and result in new funding opportunities. Eligible applicants are full-time assistant professors at ORAU member institutions within two years of their initial tenure track appointments. Awardees receive a one-year grant worth a total of $10,000. Four hundred sixty Powe Awards were made from 1991 to 2011.

This descriptive study presents a secondary data analysis of 258 survey responses received in a 2012 follow-up survey. The survey focused on Powe awardees' careers, research activities, and perceptions of the Powe Awards. Key variables studied are awardees' peer reviewed publications, research presentations, research grants, honorary awards, continued employment at institution where Powe Award was received, tenure obtainment, leadership positions, and awardees' perceptions of influence Powe Award had on their careers. Quantitative analysis of closed ended responses was supplemented by qualitative analysis of open-ended questions.

Study findings indicate that Powe awardees increase peer-reviewed paper publications and research presentations through their early and middle career stages followed by a decrease in their later career stage. Powe awardees earn grants increasingly throughout their careers and earned a total of 1,866 grants. Almost half of Powe awardees reported earning 210 awards. For Powe awardees (1996 through 2006), 88.1 percent of the survey respondents were awarded tenure and was awarded, on average, after five years of faculty service. Approximately four out of five survey respondents maintained continuous employment at the universities where they received their Powe Award. Powe awardees hold more leadership positions within their research communities than within their universities. Recipients of the Powe Award indicated in the open-ended comments that they gained confidence in their abilities as researchers early in their careers due to the Powe Award. Their comments also convey that the Powe Award funds are serving as seed money in the collection of preliminary data which is used toward earning future research grants.

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Chapter 1

Introduction

This chapter provides an overview of the study, beginning with the background of the Ralph E. Powe Junior Faculty Award and the metrics related to career trajectory. It defines the purpose and significance of this study. Research questions, assumptions, and limitations of the study are outlined, as well as the study methodology and the organization of the study. Throughout this manuscript, the Ralph E. Powe Junior Faculty Award will be referred to as the Powe Award.

Early Career Faculty – University Perspective

New tenure track faculty members can be overwhelmed adjusting to a new university, tenure expectations, and related faculty responsibilities (Trotman, 2006). The requirements for tenure include teaching and advising, service requirements, and the establishment of a research program within a faculty reward structure that is geared toward research and scholarship (Tierney, 1999). While teaching, service, and advising assignments are made by the university or department hiring the faculty member, a new faculty member must take the lead to establish an independent research program or laboratory at their own direction (Lee, 2004). Most science, technology, engineering, and mathematics (STEM) faculty require research labs that may require expensive equipment and/or computing resources for experimental and theoretical research. In order for new faculty members to conduct such research, the university or external funding source must provide funds to provide this equipment, computing resources, and potential modifications to facilities (Ehrenberg, Rizzo, & Condie, 2003).

Each new faculty member hired is an investment by the hiring university, and the universities who hire new faculty are looking for a return on this investment (Trower, 2012). To hire new faculty, a university makes an initial investment in the recruitment and hiring process as

well as in the on-boarding and orientation process required for a new faculty member. To recruit new faculty members, the start-up costs as part of the compensation package must be competitive (Ehrenberg et al., 2003). Having new faculty members establish a long-term research program is crucial for the university to recover these expenses through indirect costs from external grants or contracts awarded to the faculty. This cost recovery may take up to 10 years (Callister, 2006). For universities to have the opportunity to recover the costs of faculty start-up packages, universities must retain their faculty (Callister, 2006; Kaminski & Geisler, 2012).

Faculty attrition rates for universities have been stable from the 1970s through the 2000s (Nagowski, 2006). An analysis of the American Association of University Professor (AAUP) data from 1971–1972 through the 1988–1989 academic years reported relatively stable aggregate continuation rates for full professors between 93% and 95%, for associate professors between 90% and 92%, and for assistant professors between 84% and 87% (Ehrenbeg et al., 1991). A later study focusing on the same data for the academic years 1996-1997 through 2001-2002 showed that the continuation rates for associate professors at public universities across ranged from 90.2% to 94.3% (Nagowski, 2006). A recent survival analysis of faculty rosters determined that the median time (in terms of years) a faculty member in STEM-related departments stays at a university is 10.9 years (Kaminski & Geisler, 2012). Since this is the median, there is a 50% chance at the individual level that an individual faculty member will voluntarily leave a university by the end of the tenth year of their appointment.

Tenure is also a major decision for a university for financial reasons. For faculty members, tenure represents a secure employment relationship with protection of academic freedom in research (Layzell, 1999). Granting tenure is investing over $2 million over the career

of a single faculty member (Diamond, 2004). Kaminski and Geisler (2012) found that 64.2% of those who entered a university as assistant professors were promoted to associate professor at the same institution.

Early Career Support Programs

While universities are concerned with the economic impact of research on their campuses and retention of their workforce, funding agencies supporting research programs must be also interested in the workforce of university researchers who serve as the agencies' research principal investigators (PIs). In 2009, the National Institutes of Health (NIH) reported that the average age of PIs receiving their first research grant was increasing over time. The study also showed that both the average age of the research PIs and the average age to receive a first grant from NIH were increasing (White, Rush, and Schaffer, 2009). The implication is that when the older researchers retire, there may be an insufficient supply of younger researchers to sustain NIH's extramural research program. System dynamic simulations showed that a continuous influx of early career PIs was needed to lower the average age of the PI population (White et al., 2009). The result of NIH's study was a recommendation to change grant policies to award a minimum number of research grants to first time applicants and to increase the number of grants awarded to early career researchers (White et al., 2009).

Universities and funding agencies both have a vested interest in the hiring and retention of early career faculty. While at least 90% of total faculty continued in their positions annually (Nagowski, 2006), only 64.2% of the faculty eligible for tenure received it (Kaminski & Geisler, 2012). This means that the university had financial loses on 35.8% of assistant professor investments, since the faculty did not stay for the expected average of approximately 10 years (Callister, 2006) required to recover the start-up costs. Results from the NSF CAREER

evaluation (Carney et al., 2008) showed an early career faculty program can increase the continued employment of university faculty. For example, 81% of NSF Career awardees compared 70% of non-awardees had received tenure.

Ralph E. Powe Junior Faculty Award

In 1946, Oak Ridge Associated Universities (ORAU), was founded as a university consortium of seven universities and has since grown to over 100 member universities (ORAU, 2013b). In 1991, ORAU created a targeted early career award program to further assist breaking the cycle of early career faculty not obtaining funding early on in their new positions and as a way to support the member universities of the consortium. This study examines the long-term career and research outcomes of the Ralph E. Powe Junior Faculty Award, established by ORAU in 1991. The Powe Award program provides research funds to early career or junior faculty at ORAU member institutions (ORAU, 2013a). The Powe Award is given across multiple research fields that include the STEM disciplines (e.g., engineering and applied science, life sciences, mathematics/computer sciences, physical sciences) and education, management, and policy research fields. The award is $5,000 from ORAU and $5,000 from the awardee's university. This total $10,000 amount is relatively small compared to start-up packages in scientific and engineering fields. However, the Powe Award can serve as "seed" funds to support the development of larger grant proposals and earn grants and awards. These funds are meant to help establish these junior faculty members' research careers and provide professional development (ORAU, 2013a).

Those eligible to apply to for a Powe Award are limited only to full-time assistant professors at an ORAU member institution within two years of their initial tenure track appointment at the time of application. This restriction of applicants to those in their first two

years of a first tenure-track appointment makes the program relevant to only those faculty members beginning academic research careers.

Each university can submit up to two applications each year, so the universities may conduct an internal competition to select the best applications for nomination. Applications are sent to researchers in the fields for peer-review by faculty members in the same field of research. Each application receives three peer reviews. Final selections are made by the Policy Committee of the ORAU Board of Directors. Approximately thirty awards from the application pool are granted each year (ORAU, 2013a).

Study Problem and Study Purpose

Studies of early career faculty award or grant programs have multiple stakeholder audiences (Pion & Ionescu-Pioggia, 2003; National Research Council, 2007). These audiences include universities, funding agencies, and principal investigators. Universities have a vested interest in their early career faculty obtaining funding and holding continuous employment in their ranks. Federal funding agencies are concerned about the supply of future research PIs to apply for their grants and to carry out their scientific missions (White et al., 2009). These stakeholders seek to know if the impact of early career faculty programs will advance their participants' careers and chances of obtaining tenure. While an early career award as a first grant can begin a successful career (Lee, 2004), it is unknown how often the desired outcomes are achieved and a successful, tenured career is obtained. While Carney et al. (2008) showed that NSF CAREER awardees had achieved tenure at a rate 11 percent higher than the comparison group of NSF grantees, this study includes a different population and a vastly different award.

The purpose of this study is to investigate the career outcomes of Powe awardees over the first 21 years of the program. The outcomes of interest are research productivity, tenure obtainment, and continued employment.

This research represents the first formal study of the impact of Powe Awards, especially from the perspective of long-term outcomes. There are a number of early career grant and award programs that have been studied in the literature. For example, the National Science Foundation's (NSF) CAREER grant program was studied in 2008, and this represented a 10-year study of the program (Carney et al., 2008). The Burroughs Wellcome Fund Career Awards (Pion & Cordrary, 2008), Dermatology Foundation's Career Development Award Program (Boris, Lessin, Wintroub, & Yancey, 2012), the Doris Duke Clinical Scientist Development Awards (Escobar-Alvarez & Myers, 2013), and National Cancer Institute's (NCI) Career Development Awards (Mason, Lei, Faupel-Badger, Ginsberg, Seger, DiJoseph, Schnell, & Weist, 2013) have also been studied. The key outcome variables of these studies are discussed in the literature review pertinent to this study (Chapter Two). Overall, the outcomes of these studies show that the awardees outperform the comparison groups (typically applicants who did not receive an award, but have similar merits) meeting the goals of the programs.

Research Questions

The goal of the Powe Awards is for junior faculty to become established researchers at their ORAU member institutions. Thus, this study seeks to measure the research activities and career advancement milestones of the Powe Award recipients. The research questions around which this study was designed are:

1. To what extent do Powe awardees present their research or publish research results in peer reviewed articles over two academic years (2009-2010 and 2010-2011)?

2. To what extent do Powe awardees receive research grants in excess of $10,000?
3. To what extent have Powe awardees received awards for research that are not grants?
4. To what extent do Powe awardees obtain tenure?
5. To what extent have Powe awardees held continuous employment at the original institution of the award?
6. To what extent have Powe awardees assumed positions of leadership in universities and research communities?
7. To what extent do Powe awardees perceive the Powe Award influenced their careers?

Significance of the Study

This study will examine the career outcomes of the Powe Awards. The findings will also include data at time points over the careers of the Powe awardees for up to 21 years from the time of award. A study of the Powe awardees requires a data collection of the faculty member over different points in time to measure the long term outcomes of the award –continued employment, tenure obtainment, and career outcomes. The results of the study could lead to program improvements made by ORAU.

Context of the Study

In 2012, a survey was administered to the 460 previous Powe awardees from 1991 through 2011. The purpose of the survey project conducted by ORAU was to identify and track as many of the past Powe Awardees as possible and to gather data on their current career status. This study uses the original survey data from the 2012 study for a secondary analysis, including analysis of the comments submitted in the open-ended survey questions.

The population of the study is limited to the Powe Awardees who are faculty at ORAU member institutions. ORAU is comprised of approximately 109 Ph.D. granting institutions

mostly in the Eastern United States. However, over 21 years, the awardees may have changed positions and have had various opportunities for advancement and changes in their career paths. This is the first of a series of studies being developed to study the role of early career awards in the larger picture of workforce development in the United States.

Assumptions

This study was conducted under the following assumptions:

1. The Powe awardees reported valid information regarding their career outcomes.
2. The Powe awardees reported a complete set of responses regarding their career outcomes.
3. The author who was an employee of ORAU and conducted the tracking of Powe awardees, conducted the survey, and provided a clean final data set to the ORAU University Partnership Office staff.
4. The author's sole role with the Powe Award program was limited to this study, thereby making him a disinterested reporter.
5. The program was managed by a separate business unit from the author's and thus was managerially separate from the author.
6. The survey was conducted by the author on behalf of ORAU's University Partnership Office simply for formative program evaluation purposes.
7. The secondary analysis proposed for this evaluation was not previously conducted by ORAU to the author's knowledge.

Limitations

1. This study is based on a secondary data analysis of survey questions collected in early 2012.

2. The survey is a self-report survey. However, if elements of the data set had been collected through another procedure, such as a curriculum vitae (CV) analysis, the study would have been labor intensive.
3. The data available for this study are limited to those collected in the 2012 follow up survey of Powe awardees.
4. Data for publications and presentations are limited to the previous two academic years prior to the follow up survey, 2009-2010 and 2010-2011.
5. A previous study utilizing CV analysis to study research activities and career outcomes of scientists and engineers indicated that a CV is comparable to self-reported data (Dietz, Chompalov, Bozeman, Lane, & Park, 2000). Therefore, the data are assumed to be as valid and complete.
6. The Powe Awards is a program available at only the 109 member universities of ORAU, to which a university must apply for membership (ORAU, 2013b).
7. The junior faculty at the universities must select to apply for a Powe Award.
8. Most early career faculty award and grant programs are designed to retain faculty in fields of study as long-term researchers or as principal investigators with the funding organizations (White et al., 2009). There are many programs in existence, but not many longitudinal studies exist. This fact is further discussed in Chapter Two. Other programs in the literature do not share the same goals as the Powe Awards. Hence, many of the results from this study may only provide the initial assessment of the success of the Powe awardees in their careers.

There are multiple levels of self-selection in the population and this inhibits the generalizability of the results.

Study Methodology

This study is a descriptive, secondary analysis study exploring multiple outcomes of Powe awardees. Survey results were be analyzed with quantitative analysis, specifically frequency counts and descriptive statistics to answer the research questions. This methodology is complemented by a qualitative, thematic analysis of open-ended survey questions.

Definition of Terms

Continued employment: A Powe awardee is considered continually employed if the awardee's employment history shows continuous employment with the university where the Powe awardee received the Powe Award. If the Powe awardee was promoted in rank to associate professor or professor, or to an administration position within the university, he/she will be considered continuously employed at the same university.

Tenure obtainment: A milestone toward the long-term employment is a faculty member obtaining tenure. Tenure is the university's decision to retain a faculty member beyond a probationary period. Granting tenure implies that the university wishes to continue the employment of a faculty member for an extended period of time. Thus, tenure and continued employment are linked, but separate, measures.

Leadership positions: This term is used to describe the spectrum of positions that are perceived as leadership positions and professional service across the variety of institutions and disciplines represented by the Powe awardees. Faculty members can assume positions of department chair, a dean of a college, or within the administrative leadership of the university. There are other positions of leadership that serve the university spanning from dissertation committee chair to university-wide committee chair. Another option for faculty members is to apply for a position as a program officer in a funding agency, such as the NSF or NIH. Faculty members can serve

the research community through leadership positions in professional societies, committees (e.g., professional society or National Academies of Science), review panels, or as a reviewer or editor for a professional journal.

Publications: The publication rate of professors varies over the course of a career or age (Abramo, D'Angelo, & Dicosta, 2011). Additionally, the publishing norms can vary by discipline (Levin & Stephan, 1991). This study utilizes a narrow range of publications – two full academic years prior to the survey (2009-2010 and 2010-2011) and only peer-reviewed publications. While data were collected on other types of publications (e.g., books), the term publications will only refer to published, peer-reviewed papers. This definition is the same as used by Carney et al. (2008) to evaluate the NSF CAREER program.

Presentations: This measure refers to the number of oral presentations made at scientific conferences or those of professional associations. The full range of presentations rolled up in this definition are national meetings of professional organizations, seminars, symposia, and any forum outside of the Powe awardee's institution. Poster presentations are excluded from this study.

Research awards: There are many rewards presented by universities, professional societies, funding agencies, governments, foundations, and national academies of science (Simonton, 1997). These awards range from recognition as a fellow of the academy to prizes to recognize significant contributions to the awarding organization or a field of research. These rewards reflect the scientific recognition earned by scientists and align with the cumulative advantage theory (Cole & Cole, 1967; Merton, 1968). While prizes may include a financial reward, the rewards reported in this study exclude research grants and teaching awards.

Career Trajectory: The term “career trajectory” refers to the path of positions, honors, and publications that a faculty has taken (Dietz et. al., 2000). The trajectory is similar to the information contained on a faculty member’s CV.

Organization of the Study

Chapter One of this study introduced the problem and described the importance of the problem addressed in the study as well as study context and design components. This chapter also contains information about the research questions, assumptions and limitations of the study. Chapter Two presents a review of literature and relevant research associated with early career faculty award programs. Chapter Three offers the methodology and for the secondary analysis of the data set previously collected. Chapter Four contains an analysis of the data and presentation of the results. Chapter Five offers a summary of the study’s findings, conclusions, and recommendations for future research.

Chapter 2

Literature Review

This chapter reviews the literature relevant to this study and the research supporting the need to study research and career outcomes of early career faculty award recipients. Previous studies of early career award programs are explored to determine the status of research on career award programs as well as for determining the quantitative measures used to measure the success of the programs. Quantitative measures of research productivity (papers and grants), employment, and tenure related to the study of early career awards are specifically explored.

Introduction to early career faculty development

This section discusses the theoretical framework foundational to a focus on early career faculty development. Early success in an academic career is a basis to a successful career according to Merton (1968). Universities have a financial interest in the success of a faculty career that progresses through the requirements for tenure and promotion. When a university hires a science, technology, engineering, or mathematics (STEM) faculty member, it is more than a simple employment relationship. While the faculty member will be an instructor at the university, the relationship is symbiotic for the research of the faculty member (Diamond, 2004). The faculty member can pursue a research agenda in his/her laboratory, while the university receives recognition and indirect costs to support the research infrastructure (Ehrenberg et. al, 2003). Ultimately, this relationship can be established on a long-term basis through the tenure process (Trower, 2012).

The university makes a financial commitment to faculty through the hiring process, the faculty member's annual salary, and if earned, through tenure. The values of these investments in STEM fields range from $90,000 (Ehrenberg et al., 2003) in terms of start-up costs to a total of at least $10 million over a 35-year career of a of a single tenured faculty member (Taylor, 2010).

In many of the STEM fields, a successful research career requires access to resources such as laboratory equipment, computing equipment, access to literature, and human capital (e.g., research assistants). The costs of these resources are increasing (Ehrenberg et al., 2003) and resulting in increased competition for these resources. Resource allocation is not based on equity, but on recognition/prestige (Cole and Cole, 1973).

Cumulative advantage theory

Scientific recognition and access to resources for research are not equally distributed among the scientific community. Cumulative advantage is a theory that generalizes the Matthew Effect (Cole & Cole, 1973) and was first used to describe the stratification of the scientific research community first proposed by Merton (1968).

The theory of cumulative advantage has empirically been shown to explain the differences in publication rates. The theory is in the early stages of being applied to predict career progression milestones, such as tenure obtainment (Taypanhyavong and Zhang, 2013). Cumulative advantage also not been applied to the individual level, but the idea that small initial differences can provide significant differences later in the academic career is powerful. This is one reason why faculty, universities, and funding agencies aim to put faculty on a path to success as early as possible.

Cumulative advantage is based on the Matthew Effect, which is the idea that those with demonstrated excellence in their discipline are allocated an unequal amount of credit and resources compared to those that have not yet demonstrated excellence, i.e., early-career faculty (Cole & Cole, 1973). When a paper is published with multiple authors, the individual author with the most previously obtained scientific credit or recognition (i.e., past publications, awards) will receive most of the recognition for the research in the paper even if he or she is not the first

author of the paper (Merton, 1968). Those with more scientific recognition will have greater access to resources to perform more research to again increase the amount of scientific recognition a scientist has (Lee, 2004). These resources can include money, time, competent assistants, and access to information.

Early career faculty development is dependent on progression toward the next milestone on the academic career path. Tenure and promotion is based largely on instruction, research, publications, and service (Bakken and Simpson, 2011). Thus, career success is partially based in research outcomes which are established in the early years of the faculty career.

Early career faculty award programs

This section introduces the major early career faculty award programs designed for faculty in STEM disciplines. Two major award programs were initiated to support "young" faculty members in the 1980s. In 1983, the National Science Foundation launched the Presidential Young Investigator program, which in 1994 became the Faculty Early Career Development (CAREER) Program that continues still in 2014 (Millsap, Hill, Brigham, Garcia, Levin, et al., 2001). A second large program was founded in 1985 by the Lucille P. Markey Charitable Trust and is known as the Markey Scholars Program (National Research Council, 2006a). Since these two programs were created, other programs have been developed to support young researchers achieve success (Table 1).

Early career faculty award programs are inherently difficult to evaluate since selection bias is a very large influence. Applicants decide to apply or not apply based on a variety of factors, and programs want to select the "best and brightest". This creates differences between awardees and non-awardees that make identification of proper comparison groups very difficult (National Research Council, 2006b).

Studies included in this review were limited to those conducted since 2000 and focused on programs that provided financial support to university faculty. Searches of the Education Source, ERIC, PsycINFO, Sage Reference Online, Web of Science, and Google Scholar databases produced six relevant studies. Search terms included early career faculty, junior faculty, early career faculty awards, junior faculty awards, young faculty awards, and early career development. Results were filtered to meet four criteria: (1) program supports university faculty, (2) program eligibility includes STEM discipline(s), (3) program supports research as part of career development, and (4) early career faculty are one population eligible to apply to the program. The resultant early career programs studies (see Table 1) identified are the Leukemia and Lymph Society Scholar Program (Lichtman & Oakes, 2001), Markey Scholars (National Research Council, 2006a), Burroughs Wellcome Fund Career Awards (Pion & Cordrary, 2008), NSF CAREER Awards (Carney et al., 2008), Dermatology Foundation's Career Development Award Program (Boris et al., 2012), the Doris Duke Clinical Scientist Development Awards (Escobar-Alvarez & Myers, 2013), and National Cancer Institute's (NCI) Career Development Awards (Mason et al., 2013).

The reviews of the studies in this section cite results, but participants do not to serve as comparison groups. Without a comparison of Powe awardees to the groups in the identified studies, statistical comparisons cannot be made, nor can comparisons be made in order to draw conclusions of the study. There are differences in the target populations, award durations, program types (i.e., bridge programs from postdoctoral to faculty), and award sizes. These studies are utilized to establish context for what can be expected of a more general population of early career faculty for further study at another time. The programs provided common measures of research and career outcomes used to build research questions for studying the Powe

Table 1 – List of Studies and Evaluations of Early-Career Faculty Award Programs Since 2000

Program name	Sponsoring organization	Year established
Career Development Awards (K Awards)	National Cancer Institute	1980
Leukemia & Lymphoma Society Scholar Program	The Leukemia & Lymphoma Society	1981
Faculty Early Career Development (CAREER)	National Science Foundation	1983
Lucille P. Markey Scholar Award in Biomedical Sciences	Lucille P. Markey Charitable Trust	1985
Career Development Award	Dermatology Foundation	1990
Career Awards in the Biomedical Sciences (CABS)	Burroughs Wellcome Foundation	1994
Clinical Scientist Development Award (CSDA)	Doris Duke Foundation	1998

awardees. Below are detailed descriptions of the identified programs, including results from the evaluations relevant to the goals of the Powe Award program.

Leukemia & Lymphoma Society Scholar Program

Eligible applicants for the Leukemia & Lymphoma Society Scholars must have a record of early research success and achieved research independence by having won a significant amount of funding for research by the time of application review. The scholars are selected by a peer review committee based on their professional promise to be future productive researchers. Scholars receive up to $110,000 per year for up to four years. The researchers must pursue research on the diagnosis or treatment of leukemia, lymphoma, and myeloma.

Lichtman & Oakes (2001) compared the productivity of Leukemia & Lymphoma Society Scholars to those not selected as scholars. The study focused solely on the publication output of the scholars and two comparison groups from a nine-year period January 1, 1981 through December 31, 1999. The populations studied were the 124 scholars selected from 1981 through 1990 and a matched comparison group formed of 124 not-selected applicants. A third comparison group was gathered solely for comparison of citation rates – authors that published in the same journals in the same year as the scholars, but did not apply for the Scholar Program.

During the study period, scholars published a statistically significant number of total papers more than the matched comparison group published. The scholar's papers were cited more than the non-applicants and non-funded applicants were cited more than the non-applicants.

Lucille P. Markey Scholar Award in Biomedical Sciences

The Markey Scholar Awards in Biomedical Sciences serves as a bridge program supporting up to three years of postdoctoral training and five years of a junior faculty

appointment. The Markey Scholars were supported with salary and research funding. Being a limited term trust, the Markey Scholars program had a limited lifetime from 1985 to 1991, but supported 113 scholars during its existence. (National Research Council, 2006a).

An evaluation of the program was performed by the National Research Council. The evaluation used a comparison design with three groups representing the scholars, top-ranked applicants not selected as scholars, and non-selected applicants deemed competitive but not top-ranked.

Data were collected from a curriculum vita (c.v.) analysis, citation data, extramural funding data, administrative records, and interviews. The study focused on twelve outcome variables: (1) Current rank and institution prestige (if at academic institution), (2) tenure status, (3) time to tenure in years, (4) current position (if not at academic institution), (5) time to current position in years, (6) number of honors and awards, (7) number of journal articles, (8) number of citations, (9) number of NIH grants, (10) number of years to obtain first NIH grant, (11) number of NIH R01 grants, and (12) number of years to obtain the first R01 grant. The Markey scholars outperformed the two comparison groups in all outcome variables and the program was suggested as a model for transitioning postdoctoral fellows to independent research faculty (National Research Council, 2006a).

Burroughs Wellcome Fund Career Awards in the Biomedical Sciences

The Burroughs Wellcome Fund Career Award in the Biomedical Sciences (CABS) has the goal of producing productive researchers in the biomedical sciences (Pion and Cordray, 2008). The expected outcome is a productive researcher that is competitive in obtaining federal or other external funding. The program accomplishes this through a bridge program, which funds a total of five years combining postdoctoral and the first three years of a faculty appointment. An

evaluation of the program was conducted in 1999 by Pion and Ionescu-Pioggia (2003) over the 166 scientists that had been awarded more than $75 million.

The outcome variables studied by Pion and Ionescu-Pioggia (2003) include: (1) length of time to obtain a faculty position; (2) applications for and receipt of external research funding; (3) time spent on research and other activities; (4) amount of institutional financial support to grantee's career (size of start-up costs); (5) number of graduate students, postdoctoral researchers, and research assistants directly supervised in his/her laboratory; (6) amount of awardee's research space, and (7) awardee's views on the extent they believe the award fostered their career advancement as compared to similar training and experiences. Pion and Ionescu-Pioggia (2003) also measured publications and citations, but did not collect the data from the participants through a survey. The researchers instead gathered the data directly from the Institute for Scientific Information's (ISI) Science Citation Index.

The Wellcome Burroughs Fund CABS appears to meet the goal of producing university researchers in the biomedical sciences who have established research programs that successfully compete for external support. However, the authors report a lack of benchmarks for comparison to determine if the Wellcome Burroughs Fund Career awardees perform better than those who did not receive the award. Pion and Ionescu-Pioggia (2003) also acknowledge that more data are needed to fully determine success of the Burroughs Wellcome Fund Career Award, which requires more time to pass and more cohorts to complete their award period.

Pion and Cordray (2008) extended the original study (Pion & Ionescu-Pioggia, 2003) by identifying a comparison group of applicants who did not receive an award. Propensity score analysis was utilized to adjust the estimates for effects of the Burroughs Wellcome Fund Career Award. Instead of comparing the raw mean difference between the awardees and non-awardees,

they matched group members based on background variables (propensity score) – gender, underrepresented minority status, degree only, academic major, rank and duration of postdoctoral training, age, and publications. There were multiple comparison groups identified. The first was all top ranked applicants who were not selected; they represent the applicants that made it to the final interview round of the CABS selection process, but did not receive an award. Thirty-five top ranked applicants responded to the survey administered compared to 85 CABS award winners. The second comparison group was all non-selected CABS applicants, which also included the top ranked applicants. The total number of non-selected applicants who responded to the survey was 277.

The recipients of a CABS outperformed respondents in the comparison groups, successfully bridging from postdoctoral positions to university faculty positions. The CABS awardees received tenure at a rate of 94.1% compared to 74.3% of the top-ranked but not selected awardees and 57.5% of all non-selected applicants to CABS. More than half of the CABS awardees held professor positions at a Top 25 institution in terms of NIH funding (62.4%) compared to 48.6% of the top-ranked applicants and 32.6% of all non-selected applicants. Accessing the NIH grants database, Pion and Cordray (2008) determined that 72.9% of CABS awardees were PIs of NIH R01 grants while only 51.4% of top-ranked applicants and 34.2% of all non-selected applicants had achieved the same status. Accessing the World of Science database, CABS awardees had published on average $M = 6.6$ ($S.D. = 4.7$) peer reviewed articles compared to $M = 5.5$ ($S.D. = 4.3$) articles for the top-ranked applicants and $M = 5.3$ ($S.D. = 3.8$) for all non-selected applicants.

NSF Faculty Early Career Development Program

The National Science Foundation funds and manages the Faculty Early Career Development (CAREER) Program, which is the Foundation's most prestigious junior faculty award program (NSF, 2013). It awards junior faculty for excellence in research and instruction and promotes the integration of research and education and the awardees' home institution. Top winners of the CAREER award are nominated for the Presidential Early Career Award in Science and Engineering (PECASE).

The CAREER program had a ten-year history entering the evaluation period. Eligible applicants include all university professors at the assistant professor rank or equivalent tenure track position. The award is a total of $400,000 or $500,000 for a five-year award period, depending on the NSF Directorate funding the award. The goals of the NSF CAREER Award program are to support promising researchers through long-term support, reward top researchers, and promote the integration of research and education (NSF, 2013).

The evaluation questions used in the evaluation (Carney et al., 2008) relate to the goals of the NSF program and included: (1) how stakeholders at NSF perceived the CAREER program and how it relates to the NSF mission; (2) the impact of CAREER on research activities and career advancement of the awardees; (3) impact of CAREER on integration of research and education, and (4) how faculty members at the universities of the CAREER awardee perceive the CAREER program. Evaluation question 2 is directly related to two of the research questions in this study of the Powe Award.

The evaluation study (Carney et al., 2008) was composed of a survey distributed to a sample of 1400 of all NSF CAREER awardees and a comparison group of 1800 declined

applicants (non-awardees). The results of the evaluation are overall positive showing an impact of the CAREER Award on the awardees over non-awardees.

NSF CAREER Awards evaluation results (Carney et al., 2008) relevant to the Powe Award study included the number of papers published between 2004 and 2006, the number of presentations between 2004 and 2006, tenure obtainment, time spent on research, and if the institution of the awardees changed post-award.

NSF CAREER awardees were significantly more likely to have earned tenure than were non-awardees – 81% of awardees and 70% of non-awardees. The awardees that had earned full professorship totaled 27%, while non-awardees were no more or less likely to have earned a full professorship – 26%. Awardees also outpaced the non-awardees in the number of publications (18.9 publications versus 18.0 publications) and the number of presentations (13.4 presentations versus 12.6 presentations) over the two year period. After the NSF CAREER Award was made to awardees or the NSF grant was made to the non-awardees, 29% of both groups changed institutions. When awardees changed institutions, they were more likely to move to a more research intensive institution as ranked by research funding received by the institution (Carney et al., 2008).

Dermatology Foundation's Career Development Award

In 1990, the Dermatology Foundation transitioned a research support grant program into its Career Development Award (CDA) program. The Dermatology Foundation's Career Development Award program was established to identify future leaders in the study and treatment of dermatology diseases, and to support them in establishing an independent research career. The study was a descriptive study of the 196 awardees from 1990 through 2007. A survey was administered collecting data on the awardees' current professional rank, employment

history, grant obtainment, and a perceived impact of the award on career trajectory (Boris, Lessin, Wintroub, & Yancey, 2012).

The researchers were able to locate 181 of the 196 awardees, and of the 181 awardees, 73 percent or 132 past awardees responded to the survey. Eighty percent of the CDA awardees hold a full- or part-time position as a professor. Of respondents, 84% reported receiving subsequent research funding. Dermatology Foundation's CDA awardees received 235 NIH grants in excess of $318 million. This means that for every $1 the Dermatology Foundation invests in the CDA awardees yields over $10 in NIH funding (Boris et al., 2012).

Doris Duke Clinical Scientist Development Award

The Doris Duke Charitable Foundation supports an award to early career physician scientists or those who hold both an MD and PhD degree. The Clinical Scientist Development Award (CSDA) provides funds to early career physician scientists to allow them to dedicate a minimum of 75% of their time to research rather than clinical work. The goal of this requirement is to provide the CSDA awardee with a mentored research experience with the goal of the awardee earning an NIH R01 research grant and thus being considered an independent researcher. From 1998 through 2011, there were 1,441 CSDA grants awarded (Escobar-Alvarez & Myers, 2013).

The study of the Doris Duke CSDA program compared data from 120 CSDA awardees with those of a comparison group of 105 former applicants that scored highly but were not awarded. A survey was administered to the awardees and comparison group members asking about their professional activities (e.g., research, teaching, or clinical), time spent on research, and grant obtainment of an R01. The CSDA awardees outperformed the comparison group members in earning R01 grants. However, when compared to the equivalent NIH mentored

research experience early career award, K23, the CSDA awardees underperform earning R01 grants (Escobar-Alvarez & Myers, 2013).

National Cancer Institute Career Development Awards Program

The NCI funds a portfolio of career develop awards called K awards. A study was performed of seven award mechanisms of the portfolio – K01, K07, K08, K11, K22, K23, and K25. The population studied included 293 awardees just above the cut score for funding and 293 applicants just below the cut score. The data sources used in the study were bibliometric and administrative data (Mason et al., 2013)

Outcome variables were obtainment of NIH research grants, time to obtain the first NIH research grant post K award, number of publications in each fiscal year post award, and engagement in the scientific community. Engagement in the scientific community included, but not limited to, membership in professional societies, serving on federal advisory or review panels, registered health provider, or registered in the national clinical trials database. Results showed that the K awardees outperformed the comparison group in NIH grant obtainment, percent of researchers publishing research results, and median number of publications. The K awardees and the comparison group members did not have statistically significant differences in the time to first NIH research grant (Mason et al., 2013).

Common measures

Table 2 displays a summary of the outcome measures used in the studies of early career award programs. Of all studies, five used the number of papers as one of the indicators of a successful career. Three studies used the number of external grants, two studies used NIH grants, and two studies used the number of NIH R01 grants as proof that the faculty had become independent investigators with their own research agendas. Three programs surveyed or

Table 2 - Comparison of Outcome Variables of Early Career Faculty Award Programs

	Leukemia & Lymphoma Scholar Program	Lucille P. Markey Scholar Award	Burroughs Wellcome Fund Career Awards	NSF Faculty Early Career Development Program	Dermatology Foundation's Career Development Award	Doris Duke Clinical Scientist Development Award	National Cancer Institute Career Development Awards
Current academic rank		X		X	X		
Time to faculty/current position		X	X				
Amount of institutional financial support (start-up costs)			X				
Employment History/Current Position		X			X		
Tenure obtainment		X		X			
Time to tenure		X					
Percent time spent on research			X	X		X	

Table 2 (continued)

	Leukemia & Lymphoma Scholar Program	Lucille P. Markey Scholar Award	Burroughs Wellcome Fund Career Awards	NSF Faculty Early Career Development Program	Dermatology Foundation's Career Development Award	Doris Duke Clinical Scientist Development Award	National Cancer Institute Career Development Awards
Number of external grants			X	X	X		
Number of NIH grants	X						X
Number of NIH R01 Grants	X					X	
Time to obtain first NIH grant	X						X
Time to obtain first NIH R01 grant	X						
Number of papers published	X	X	X	X			X
(Mean) Number of Citations	X		X	X			
Number of presentations				X			
Engagement in science community							X

Table 2 (continued)

	Leukemia & Lymphoma Scholar Program	Lucille P. Markey Scholar Award	Burroughs Wellcome Fund Career Awards	NSF Faculty Early Career Development Program	Dermatology Foundation's Career Development Award	Doris Duke Clinical Scientist Development Award	National Cancer Institute Career Development Awards
Type of professional activities (research, teaching, clinical)						X	
Number of graduate students, postdoctoral fellows, and research assistants directly supervised			X				
Amount of research space			X				
Number of honors and awards		X					
Engagement in instruction (teaching or outreach)				X			
Percent time on instruction				X			
Perception of award on career advancement			X	X	X		

interviewed their awardees to determine the perceived impact of the early career award on their professional development. Three programs used current academic rank, and two programs used current position or employment history to assess success of advancing in an academic career. Another indicator of advancement was tenure obtainment, which was used by two of the programs.

The research questions developed for the Powe Award study reflect the majority of outcomes valued in the studies of the early career programs funded by the NSF, NIH, and the philanthropic foundations. A summary of the key outcomes from the other early career programs to the research questions in this study is presented in Table 3. Research question 1 explores the number of peer-reviewed publications and presentations, which a majority of the other studies also examined. This study uses the same question as the NSF CAREER Award and asks only for publications and presentations over the previous two complete academic years. Research question 2 is the number of grants over $10,000 obtained by Powe Awardees and reflects a measure studied in some form by all seven programs. Research question 3 reports on the number of honorary awards have been received by Powe awardees and is a measure used by only the Markey Scholars evaluation. Research question 4 reports tenure obtainment by the Powe awardees and is measured used by two of the programs – Markey Scholars and NSF CAREER. Research question 5 uses the employment history of Powe awardees to determine continuous employment at the institution where the Powe Award was received.

Two programs used the current position of the awardees and three used the current rank of the awardee reflecting importance of the positions held by awardees to justify that selection processes correctly identified researchers with professional promise. Research question 6 reports a sample of leadership positions in the university and research community to demonstrate

Table 3 - Comparison of Powe Research Questions to other Early Career Faculty Award Programs

Powe Award Research Questions	Leukemia & Lymphoma Scholar Program	Lucille P. Markey Scholar Award	Burroughs Wellcome Fund Career Awards	NSF Faculty Early Career Development Program	Dermatology Foundation's Career Development Award	Doris Duke Clinical Scientist Development Award	National Cancer Institute Career Development Awards
Research question 1 – papers published/ presentations given	X	X	X	X			X
Research question 2 – grant obtainment	X		X	X	X	X	X
Research question 3 – research honors/awards		X					
Research question 4 – tenure obtainment		X		X			
Research question 5 – continuous employment		X			X		
Research question 6 – leadership positions							X
Research question 7 – perception of award on career			X	X	X		

recognition of the awardees as leaders or experts in their fields. Only the Burroughs Wellcome Fund Career Awards uses a similar measure called engagement in the field reflecting the fact that depending on the scientific field, there are other positions than faculty positions that researchers can use to advance their field of study. Research question 7 uses survey comments to report on the perceived influence of the Powe Award on the awardees' career. Three programs also explored the perceptions of the awards on the careers of the awardees.

Indicators of faculty career trajectory

Lifetime productivity cycle for researchers

The ability for researchers to perform original research could be increased by cumulative advantage as the age of the research increases, but Kyvik & Olsen (2008) propose several factors that might interfere with this process. As a faculty member is promoted, their responsibilities change to reflect greater responsibilities in the governance of the university. As a researcher ages, the scientific credit they receive decreases, and the motivation to pursue more research decreases. Aging researchers may operate at a lower intellectual and physical level. Thus, they cannot keep up with the introduction of new technology and new scientific questions. However, no single theory can be proven since there are overlaps in these theories and confounding variables (Kyvik & Olsen, 2008).

Age is a factor that has been studied as it relates to the research ability and productivity of research faculty. The issue could be important because extraordinary achievements that are awarded by a Nobel Prize or Fields Medal usually occur before the age of 40 (Gingras, Larivière, Macaluso, & Robitaille, 2008). Simonton's (1997) model of creativity states that individuals have an initial creative potential to produce original research that decreases over time. This decrease is not a function of chronological age, but career age.

A study by Levin and Stephan (1991) show that, on average, that as researchers get older, their productivity decreases. But Simonton's model (1997) shows that productivity should increase to a certain age and then start a decreasing path. According to Wray (2004), the largest percent of practicing scientists studying bacteriology were "young" (35 or younger). However, a 51.4% of discoveries in bacteriology were attributed to "middle-aged" researchers aged 36 – 45. Given the conflicting results of studies, the effects of age on research productivity remain an open question (Abramo et al., 2011).

Measures of publications

Studies of the Leukemia & Lymphoma Scholar Program (Lichtman & Oakes, 2001), Markey Scholars (National Research Council, 2006a), NSF CAREER Awards (Carney et al., 2008), and NCI Career Development (K) Awards (Mason et al., 2013) reported the number of peer-reviewed publications for the awardees. While the NSF CAREER evaluation (Carney et al., 2008) collected the number of papers from the awardees via a survey but confirmed the information with bibliometrics.

Searches of the appropriate database (i.e., Web of Science or MEDLINE) can be used to identify the number of papers for awardees. Citation analysis can be conducted with author name searches in Institute for Scientific Information's (ISI) Science Citation Index. There are technical challenges to using bibliometrics and citation analysis. The greatest problem in using databases to count the total number of articles by an author is the correct matching of an awardee to the name in an author list on a publication. Without a unique identifier common across all disciplines, publications can be incorrectly added or deleted from the total for an awardee (Pion & Cordray, 2008).

Citation analysis seeks to measure scientific quality or influence by measuring the number of times it is cited by subsequent papers. This practice has been criticized because some measures cannot eliminate self-citations, where an author cites his/her previous papers (Bornman, Mutz, Neuhaus, & Daniel, 2008). Self-citation may be appropriate, but can also be done to simply increase the number of citations attributed to that particular author. Another issue that increases the difficulty of interpreting citation analysis is the publishing norms across scientific fields. Illustrating the difficulty of being cited in different fields, Podlubny (2005) states, "one citation in mathematics roughly corresponds to 15 citations in chemistry, 19 citations in physics, and 78 citations in clinical medicine" (p. 98).

Curriculum vitae (CV) analysis would be ideal to collect data on publications and presentations (Gaughan & Ponomariov, 2008). Almost all faculty and researcher have a CV, which includes information on employment history, publications, presentations, grants, and honors and awards, and the key outcomes of interest in the current study. However, this methodology has only been used in a limited capacity, due to the technical challenges. The coding requires an enormous amount of work which can lead to coder fatigue and introduce error (Dietz et al., 2000).

A database of CV data could be mined for a wealth of information, but the validity and reliability of the data must be considered. The data may not be current and thus missing information. Gaughan and Ponomariov (2008) found that the CVs posted online were either tailored for a specific purpose or were out of date, in some cases by years. Another factor is CV data are self-reported and no more reliable than a survey (Dietz et al., 2000).

Grant obtainment

The shrinking of university budgets makes university researchers increasingly dependent on external funding to perform research (Laudel, 2006). Research PIs may have to change their research to fit the program or institution with whom they identify to submit a research proposal. The result is a resource environment that is increasingly competitive for scarce resources (Freeman et al., 2001). For the funding institutions, the increased competition is meant to generate higher quality research and thus create an innovative research system (Laudel, 2006). So, early career grants occur at a critical point that can have a large influence on the career trajectory of the recipients (Benowitz, 1997).

Lee (2004) studied the obtainment and effects of a first grant on early career faculty. On average, the time lag from receipt of Ph.D. to first research grant was three years. The sciences had a greater time lag to first grant than engineering fields, but the study did not account for postdoctoral research norms within disciplines. The findings of the study show that grants for early career scientists serve as career boosters, leading to researchers with greater productivity. Although policy attention is given to early grants, the impacts of these grants have not been evaluated systematically yet (Viner et al., 2004).

Research awards

The academic research enterprise resembles an economic model of a tournament (Freeman, Weinstein, Marincola, Rosenbaum, & Solomon, 2001). A tournament offers all participants the chance of winning a prize through competition (Lazear & Rosen, 1981). The prizes sought by academics might include tenure, promotion, longer research career, or research award. The competition can turn small differences in research productivity into large differences that result in scientific recognition and awards. These differences among the possible rewards

exceed the differences in output, thus creating a disproportionate incentive to win the tournament.

Victory may result from being just slightly better than the other competitors. In a conversation with Nobel Laureate Doug Osheroff (personal communication, July 1, 2012), he indicated that he believes he won the Nobel Prize by understanding the results of his experiment weeks earlier than another physicists also studying helium-4 and by publishing the results first. The pressure to finish first can create perverse outcomes (Lazear & Rosen, 1981). The pressure can lead researchers to publish quickly and to recruit more laboratory assistants to conduct even more experiments without consideration of their training (Freeman et al., 2001).

The tournament model of research awards can possibly be mediated with early career awards. They provide a temporary award to mediate the incentive to pursue tenure-worthy research and to publish only in high quality journals (Trower, 2012).

Tenure

Early career awards like the Powe Award are established to help the awardees begin a long, productive career as a university researcher (ORAU, 2013a). On the path of that career is promotion to higher ranks of associate and full professor, along with the determination of tenure (Taylor, 2010). Tenure is a milestone along the career path of Powe awardees, so it is a measure of importance for the current study.

Faculty members accept tenure-track positions with the expectations of meeting the requirements for tenure and promotion (Trower, 2012). However, one of the hindrances to obtaining tenure is changing university expectations during the time period that early career faculty are trying to meet the requirements (Trower, 2012). The tenure decision is typically based on general criteria: (1) teaching, (2) service, and (3) scholarship (Bakken & Simpson, 2011).

The teaching evaluations of students, the professor's scholarship, and peer evaluations are common instruments to judge instructional criteria toward tenure (Trower, 2012). Service to the university and department can be documented to show participation in various committees and taskforces (Diamond, 2004).

The scholarship criterion refers to the research endeavors of a faculty member. It is difficult to evaluate scholarship in order to determine if the junior faculty member has matured enough to be an independent investigator. It is easy to simply count papers via bibliometric techniques or to use one of the indices that measure citation analysis (Bakken & Simpson, 2012). External grant obtainment is another measure toward tenure, as it can demonstrate the ability to pursue a sustained line of research (Trower, 2012).

Even new faculty members who were hired with the most impressive academic credentials find themselves struggling and failing to adjust to the norms of a new university (Taylor, 2010). Thus, it is not a mastery of the discipline and its content, but one's ability to perform the academic work that determines tenure (Solem & Foote, 2004).

Early career faculty programs like the Powe Award seek to identify promising young scientists and engineers, support their research (ORAU, 2013a), and help establish the awardee in this component of a tenure evaluation.

Continuation rates in the professoriate

While funding agencies do not have control of or influence over the employment practices or decisions at universities, their grant decision criteria favor more experienced and thus older PIs (Viner et al., 2004). With less experienced researchers at a disadvantage, it is easy for them to become discouraged and pursue different research lines, change discipline fields, or even leave academia (Cole & Cole, 1973). NIH studied the age issue of PIs because in 2001 just

251 out of 6635 research grants were awarded to people 35 or younger (Tighman, 2002). The systems dynamics study of White et al. (2009) provided NIH with multiple options for policy changes to change the trend of an aging PI population.

There is not a central census of university faculty members at the National Science Foundation (tracks Ph.D. scientists and higher education R&D funding) or at the National Center for Education Statistics (tracks higher education institution enrollments and degrees), making the determination of retention or attrition of university faculty difficult (Hagedorn, 2000). Therefore, the two most recent studies in the literature use data from the AAUP salary survey (Nagowski, 2006) and faculty rosters of universities from online catalogs (Kaminski & Geisler, 2012).

Any voluntary departure of a faculty member at a university carries both costs (NRC, 2007) and benefits (Nagowski, 2006). Replacement costs are much higher than costs to retain faculty and include the loss of research and grant productivity of a faculty member (NRC, 2007). Additionally, there are disruptions in teaching assignments, graduate and undergraduate student advising, and any impact the faculty member had on institutional governance. There are also impacts to departmental morale or academic reputation depending on the reputation of a faculty member who left (Nagowski, 2006). The benefits for a university can include the use of previously committed salary for a younger faculty member, ability to redistribute resources across laboratories or departments, and the opportunity to increase diversity of the faculty (NRC, 2007).

Retention rates are not expected to be 100 percent, because the fastest and most direct path to a promotion in rank and/or a substantial pay increase would be from an offer of a new position at another university (Hagedorn, 2000). As discussed in Chapter one, a retention rate less than 85 percent would represent the loss of a year’s hire of assistant professors.

Ehrenberg et al. (1991) studied the AAUP salary survey data across two decades starting in academic year 1971–1972 and ending with the 1988–1989 academic year. They found relatively stable aggregate continuation rates for professors. Assistant professors had continuation rates between 0.84 and 0.86. Both full and associate professors had continuation rates between 0.90 and 0.92.

Nagowski (2006) studied the turnover of associate professors using data from the American Association of University Professor's annual salary survey. He argues that the associate professor rank gives the best indication of voluntary departures from a university. The assistant professor rank is tainted by those turned down for tenure, while full professor rank has those leaving for age-related issues (i.e., retirement). Nagowski's study covered the academic years 1996–1997 through 2001–2002. In order to use the continuation rate of associate professors, Nagowski carried out a weighting adjustment, norming the results for the number of faculty at the universities. This procedure normalizes the data among the universities with vastly different enrollments. The results for Nagowski's study are presented in Table 4, but just the results of Ph.D. universities (360 universities). This limitation of results is due to the characteristics of the ORAU member institutions – Ph.D. granting institutions.

Kaminski and Geisler (2012) followed the faculty rosters of 14 universities including four ORAU institutions – George Washington University, Georgia Institute of Technology, University of Delaware, and Virginia Tech. From 1990 through 2009, faculty from physics, chemistry, mathematics, biology, electrical engineering, mechanical engineering, computer science, civil engineering, and chemical engineering were tracked. All of these departments reflect the categories of the Powe Award. The retention rate of the associate professors tracked was 0.927 after 8.5 years and 0.929 after 10 years. These findings are consistent with the

Table 4 - Weighted continuation rates, four-year institutions

Academic Year	Public Universities	Private Universities
1996 – 1997	0.928	0.936
1997 – 1998	0.916	0.943
1998 – 1999	0.910	0.936
1999 – 2000	0.907	0.930
2000 – 200 1	0.902	0.933
2001 – 2002	0.904	0.926

Source: Adapted from "Associate Professor Turnover at America's Public and Private Institutions of Higher Education," by M. P. Nagowski, 2006, *The American Economist*, p.72.

Ehrenberg et al. (1991) and Nagowski (2006) results.

Additionally, Kaminski and Geisler (2012) reported that 64.2% ± 3.65% of faculty who entered one of the universities were promoted to associate professor rank. Through a survival analysis, the chance that a faculty member would be retained was less than 50 percent, with a median time to departure is 10.9 years. The retention for mathematics was the lowest. Additionally, Kaminski and Geisler reported the post-tenure faculty leave at a rate lower than pre-tenure faculty. The mechanisms related to tenure are convoluted. Ehrenberg et al. (1991) and Nagowski (2006) reported a strong effect of faculty salary on retention. But the variables not currently measured include the active recruitment of faculty to other institutions, the voluntary departure due to tenure pressures, dismissal of faculty for failure to meet tenure requirements, or the departure of faculty from academia altogether.

Summary

This section presented the literature on issues related to the hiring of early career faculty and recent studies on seven early career faculty award programs. Early career faculty can have difficulty obtaining grants because past grant success gives applicants an advantage (Cole & Cole, 1973). The goals of early career faculty award programs reflect the theory of cumulative advantage; i.e., that providing early success to faculty members will allow them to access the resources necessary for a successful career.

Seven early career faculty programs were reviewed for common measures of key outcomes. Five of seven studies used publications; six studies used grant obtainment; one study used research honors and awards; two used tenure obtainment; two used employment history; one used leadership positions, and three used the perceptions of the awardees of the award on their careers. Six of the studies showed that the awardees outperformed the comparison groups,

except for the Burroughs Wellcome Trust Career Awards (Pion & Cordrary, 2008) which shows that the awardees perform better, but not statistically significantly better. Therefore, the results of an early career award program are not guaranteed, and the Powe Award program should be studied for research and career outcomes that align with its goals.

Powe Award Program

The history of the Ralph E. Powe Junior Faculty Award is a reflection of the overall history of sponsoring institution, Oak Ridge Associated Universities (ORAU). In 1946, University of Tennessee physics professor Dr. William Pollard had a discussion with a fellow professor Dr. Katherine Way at a dinner party discussing the merits of linking the scientific resources recently developed in Oak Ridge as part of the Manhattan Project with regional universities (Pollard, 1980). He put together a consortium of fourteen universities to form the Oak Ridge Institute of Nuclear Studies (ORINS).

The first program implemented by ORINS was the Graduate Training Program to provide graduate students an opportunity to carry out thesis or dissertation research at the federal government's laboratories. This was shortly followed by the Research Participation Program, which brought university faculty members to the federal facilities as well (Pollard, 1980).
In 1966, ORINS became Oak Ridge Associated Universities (ORAU). While the name changed, the mission remained the same. Currently, ORAU has over 100 (doctoral granting) member universities and 14 associate members in the consortium (ORAU, 2013b).

In 1991, ORAU began the ORAU Junior Faculty Awards program with five grants. In 1998, the name of program changed to the Ralph E. Powe Junior Faculty Awards. The Powe Awards are designed to provide seed money for research by junior faculty at ORAU member

institutions. These awards are intended to enrich the research and professional growth of young faculty and result in new funding opportunities (ORAU, 2013a).

All applicants must submit applications through the ORAU Councilor at the university. The ORAU Councilor is a single point of contact linking ORAU to its member institutions, usually the Vice President of Research or a scientific dean at the institution. An application from a faculty member consists of a two page resume or curriculum vitae (c.v.) with one page of personal information and one page dedicated to publications and presentations. In addition, the applicant submits a research proposal consisting of research goals and objectives, including relevant background; expected research outcomes and their relevance; research design and methodology; competence of the applicant to perform the proposed research; the available research facilities and resources, and a budget justification. The third component of the application is a letter of nomination from the applicant's department chair or dean (ORAU, 2013a).

In addition to the research proposal, scientific merit also includes any proposed research collaborations proposed by the faculty member. The establishment of these collaborative relationships can benefit the faculty member, his/her university, and the collaborating organization. ORAU has a close relationship with Oak Ridge National Laboratory (ORNL), so collaborations with ORNL are given extra positive scores (ORAU, 2013a).

Chapter 3

Methodology

This chapter frames the study's design, describes its context and participants; explains data collection procedures and instruments, and provides details regarding the data analysis. This was a descriptive study using a quantitative secondary analysis of survey data supplemented with thematic analysis of open-ended questions in the survey. The descriptive study design describes the career outcomes of the Powe awardees related to research outcomes, tenure obtainment, continued employment, leadership positions, and professional development.

An NSF funded evaluation of its CAREER program utilized a longitudinal follow-up study of past awardees to measure long-term impacts (Carney et. al., 2008). The present study used a similar technique to answer the research questions posed. The purpose of this study was to investigate the career outcomes of Powe awardees over the first 21 years of the program. The outcomes of interest are research productivity, tenure obtainment, continued employment, leadership positions, and professional development.

Seven research questions guided this study, as follows:

1. To what extent do Powe awardees present their research or publish research results in peer reviewed articles over two academic years (2009-2010 and 2010-2011)?
2. To what extent do Powe awardees receive research grants in excess of $10,000?
3. To what extent have Powe awardees received awards for research that are not grants?
4. To what extent do Powe awardees obtain tenure?
5. To what extent have Powe awardees held continuous employment at the original institution of the award?

6. To what extent have Powe awardees assumed positions of leadership in universities and research communities?
7. To what extent do Powe awardees perceive the Powe Award influenced their careers?

Study Design

The design of this research study was a descriptive study utilizing a secondary analysis of data from a single survey. The analysis replicated portions of and expanded upon previous research (Carney et. al., 2008) that examined the career trajectories of NSF CAREER award program winners. The Carney study reported the research productivity and career outcomes of NSF CAREER awardees. Specifically, the Carney study reported publications, presentations, and tenure obtainment. This study differed from the Carney study of the NSF CAREER Program by also capturing the Powe awardees' perceptions of the impact of the award on their careers, their continued employment at the original university of Powe Award, their research awards, and their leadership positions.

Each participant included in the study was a recipient of a Powe award between its inaugural year of 1991 and the year 2011. To be eligible for an award, awardees had to be tenure-track faculty members within their first two years at a university that is a member of the ORAU consortium.

While multiple studies have investigated faculty career trajectories, there is not a universally agreed upon system for operationally defining academic productivity in an academic career (Bozeman, 2006). The most common measures of research activities include items that can be objectively measured or counted, such as papers and awards (Gaughan & Ponomariov, 2008). Other variables used in the study related to research activities and career advancement

included the obtainment of tenure, leadership positions held, and grant obtainment. The variables analyzed in the secondary analysis of the existing survey data are described in Table 5. For the thematic analysis, Awardees' open-ended comments were used to identify the perceived impacts to the Powe Awardees.

Study Context

This study is a secondary analysis of survey data collected in 2012 by ORAU and internally funded by its University Partnerships Office (UPO). The Powe awardees were tracked and contacted by the study author. An ORAU Institutional Review Board (IRB) approved survey was conducted in early 2012 in order to present data at the ORAU Council Meeting in March, 2012. The data were also used to produce a flyer for the Powe Award program to promote it at ORAU member universities, recruit future applicants, and inform stakeholders of past programmatic success. This study builds upon that foundation to extend the study to further characterize the Powe awardees' careers and their successes. The University of Tennessee's IRB approved this dissertation study as a secondary data analysis in May, 2014.

Population

This study describes the past awardees of the Ralph E. Powe Junior Faculty Award. There were 460 awards made since the Award's inauguration in 1991 through 2011. These twenty-one years of awardees represent the survey population and are described via award year, research discipline, and ORAU member university at time of award in Appendix A.

Of the 460 awardees, the final data set consists of 258 responses. The response rate calculation is described below. When each year is analyzed individually, the lowest response rates are from the awardees of 1991 and 1992 (Table 28). The sample also includes Powe awardees from 80

Table 5 - Explanation of career success and research activities variables

Variables	Explanation
Publications	Number of number of peer-reviewed articles published or in-press over two academic years (2009-10 and 2010-11)
Presentations	Number of invited presentations at national meetings, oral presentations made at national meetings, and invited presentations (i.e., seminars) outside their institutions over two academic years (2009-2010 and 2010-2011)
Grants received	Number of grants $10,000 or more received since receiving their Powe award
Research awards	Number and source of any honorary recognition for research excluding not research grants and teaching awards
Tenure	Tenure was awarded to the Powe awardee by a university
Continued Employment	University where awardee received his/her Powe Award is the continuous employer of the Powe awardee until the time of the survey.
Leadership positions	Positions held by an awardee are positions of leadership and professional service within a university department, university, or discipline field. University positions include, but not limited to department chair, dean, or chancellor/president positions. Leadership positions in the discipline are reflected through review panels for federal agencies, National Academies of Science panel, involvement as reviewer or editor of professional journals, or positions of leadership within professional societies.

distinct universities (Table 30), while the population included awardees from 94 distinct universities (85%). The Powe Awards are given in the fields of physical sciences, life sciences, engineering/applied sciences, mathematical/ computer science, or policy, management, and education disciplines. Across all of the disciplines, there was an average response rate of 52% for each field (Table 29). Thus, the data set represents the Powe awardees across time, universities, and disciplines.

Survey Data Collection

During March 2011, the survey project began with a tracking effort to find as many former Powe Award winners as possible. The tracking effort was conducted by this study's author and supported by a graduate student. Searches were mainly conducted through Google and social media (i.e., LinkedIn) to identify university-based faculty information, searches for publication by the awardees, or social media. During the tracking process, three Powe Awardees were discovered to have passed away between the time of their award and the fall of 2011. Additionally, tracking efforts failed to locate seven past awardees. Six of the seven that could not be located were from the earlier years of the program, 1991 – 2000. Thus, some type of last known location was identified for 453 out of 460 past awardees or 98.5% of the potential survey respondents. ORAU's IRB approved the survey as an exempted study on February 14, 2012 and the survey was launched 13 days later on February 27th. The data from the survey are used as the data set analyzed in this study. The University of Tennessee approved the secondary analysis of the data as the subject of this dissertation.

Survey Instrument

The survey used in this study was modified from the NSF CAREER survey conducted by Abt Associates (Carney et. al., 2008). From the original survey, all questions related to the NSF

CAREER goal of integrating education and research activities were deleted as the Powe Award does not share a similar goal. Remaining questions from the original survey that were retained were modified from the NSF CAREER name to the Powe Award name. Two questions were added to the original survey seeking the respondents' perceptions of the Powe Award program. The survey text can be found in Appendix B. The elements of the survey data set utilized in this study are the questions related to most current position, publication information, research awards, grant obtainment, tenure obtainment, leadership positions, and the awardees' perceptions of impact of Powe Award on their career and tenure obtainment. Table 6 identifies the survey questions used to answer the research questions.

Data Collection

The survey was hosted online via the ORAU online survey software, SelectSurvey. A pilot test of the survey was conducted in February 2012 with four professors at the University of Tennessee and two Ph.D. scientists at ORAU who were not Powe awardees. This low number was used since the pilot test was conducted primarily to examine the wording and directions for the three new and six modified questions of the survey. Feedback from the pilot test resulted in minor edits to the final survey text to clarify instructions only.

Individual links to the survey were sent via e-mail to the Powe awardees on Monday, February 27, 2012. Two e-mail reminders were sent to those who had not completed the survey on Thursday, March 2, 2012 and Tuesday, March 6, 2012. It was assumed that two weeks was sufficient time to respond to the survey. The survey closed on Monday, March 12, 2012 for a total period of 14 days for completion of the survey.

Table 6 - Survey Question Numbers for Powe Study Research Questions

Research question	Research question topic	Survey question number
1	Peer-reviewed publications	16
1	Presentations of research results	17
2	Grants received – number of grants	26
2	Source of grants received	27
3	Research awards	25
4	Tenure obtainment	3
5	Continuous employment	1
6	Leadership positions – department level	18
6	Leadership positions – university level	19
6	Leadership positions – research community	23
7	Perceived impact of Powe Award – continuation of Powe research	42
7	Perceived impact of Powe Award – professional development	43

Note: The text of the survey questions, response categories, and response types can be found in Appendix B.

Survey Response Rate

The final responses to the survey included a total of 273 responses. Of those 273, only 258 were considered complete or partially complete, 15 were duplicate submissions with no data or less data than a complete submission, and seven responses contained no data at all. Additionally, there were seven declinations to take the survey recorded by SelectSurvey.

The response rate for the survey was calculated with the American Association for Public Opinion Research's *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys* (AAPOR, 2011). Response Rate 6 (RR6) assumes that there are no cases of unknown eligibility and that there are no unknown cases. RR6 is calculated by dividing the total of complete and partially complete surveys by the total of those completed surveys, partially completed surveys, the declines, and non-contacts. While the number of Powe Awards was 460, only 457 awardees were suspected to be alive at the time of the survey to possibly complete the survey. Thus, RR6 = 258/457 = 0.565 or a response rate of 56.5% to the survey resulted.

Analysis of Data

Data Cleaning

The raw survey data were downloaded from SelectSurvey as a comma separated value (csv) text file. The data were initially opened in Microsoft Excel as a spreadsheet for cleaning. Matrix questions when downloaded from SelectSurvey are grouped into single cells. The data were processed through a series of data expansions and the deletion of markings that SelectSurvey uses to separate matrix question responses, so each individual cell contained only a single response to a survey question.

Some respondents abandoned the survey before completion. Seven respondents did not enter any data so their entries were deleted from the data set. Fifteen responses were duplicate

entries in that the respondents abandoned the survey, but re-entered the survey at another time, creating multiple responses. A single survey response was retained for each respondent who provided multiple responses, which resulted in eight single responses. The final data set has 258 single responses.

There were three possible situations leading to the combination of multiple responses to a given question: (1) respondent only answered the question one time across multiple survey responses, (2) respondent answered the question multiple times across the surveys with the same answer each time, or (3) respondent answered the question multiple times across the surveys with different answers. For questions with situation 1, the single response provided was retained in the final data set. In the second situation, the original response was retained. For questions where situation 3 existed, the response from the last survey entry was kept in the final data set.

Quantitative Analysis

The data set was loaded into IBM SPSS Statistics for Windows, Release Version 21.0. In the SPSS Statistics package, the data were coded into numerical values. Variables, coding schemes, and analysis methods are described and matched to the research question in Table 7.

Research question 1 uses responses reporting the number of peer-reviewed publications and the number of presentations given over the 2009 – 2010 and 2010 – 2011 academic years. This limited time period and scope for peer-reviewed journal articles is what was used in the Powe awardee survey, which was based on the survey administered to the NSF CAREER awardees (Carney et al., 2008). With respondents covering all 21 years, the publication rate was expected to change with career age (Abramo, D'Angelo, & Dicosta, 2011). Publication and presentation productivity would also be effected by the type of organization or institution employing the respondent during the 2009 – 2011 time period. To control for these effects, the

Table 7 – Procedures for Data Analysis

Research question	Variable name	Method of analysis
Q1 - To what extent do Powe awardees present their research or publish research results in peer reviewed articles over two academic years (2009-2010 and 2010-2011)?	Publications	Total number, range, mean, standard deviation, and median number of publications within Powe Award year and by research intensive and non-research intensive institutions
	Presentations	Total number, range, mean, standard deviation, and median number of presentations within Powe Award year and by research intensive and non-research intensive institutions
Q2 - To what extent do Powe awardees receive research grants in excess of $10,000?	Grants	Total number, range, mean, standard deviation, and median number of grants within Powe Award year and by research intensive and non-research intensive institutions
Q3 - To what extent have Powe awardees received awards for research that are not grants?	Research Awards	Frequency counts reported as percentage of population within Powe Award year
Q4 - To what extent do Powe awardees obtain tenure?	Tenure	Frequency counts reported as percentage of population within Powe Award year
Q5 - To what extent have Powe awardees held continuous employment at the original institution of the award?	Continued Employment	Frequency counts reported as percentage of population within Powe Award year

Table 7 (continued)

Research question	Variable name	Method of analysis
Q6 - To what extent have Powe awardees assumed positions of leadership in universities and research communities?	Leadership	Frequency counts reported as percentage of population within Powe Award year
Q7 – To what extent do Powe awardees perceive the Powe Award influenced their careers?	Powe Impact	Themes and frequency counts

responses were sorted by Powe Award year and then within each year they were subdivided into academic research institution (i.e., a Carnegie classification of research intensive) and non-academic research institution (i.e., industry or baccalaureate college). Within each stratification (Powe Award year and institution type), the results reported are the number of responses (*n*), total number of peer- reviewed papers, range of peer-reviewed papers, mean number of peer-reviewed papers, standard deviation of peer-reviewed papers, median number of peer-reviewed papers, total number of presentations, range of presentations, mean number of presentations, standard deviations of presentations, and median number of presentations.

The measure for research question 2, grant obtainment, reports the number of grants of $10,000 or more that Powe awardees received, excluding those earned as graduate students or postdoctoral researchers. Given the eligibility requirements of the Powe Award (first two years of first tenure-track position), it is assumed for analysis that all reported grants were awarded after the respondents received their Powe Award. Grant obtainment can be effected by cumulative advantage (Merton, 1968), so the results were be sorted by Powe Award year to control for career age. Responses were stratified in the same manner used for papers and presentations (research question 1); the responses were sorted by Powe Award year, and, then, within each year they were subdivided into academic research institution and non-academic research institution. Within each stratification (Powe Award year and institution type), the results reported are the number of responses (*n*), total number of grants, range of grants, mean number of grants, standard deviation of grants, and median number of grants. A separate analysis of the sources of the grants (i.e., federal agency) is reported simply as the total from each source by Powe Award year.

Research question 3 asked for the source of awards to respondents honoring the Powe awardee's research (other than grants). This does not include teaching awards. The responses are sorted and divided by Powe Award year. Within each year, the percentage of respondents reporting an award was reported by source of the award. A list of potential sources of research awards accompanied question 25 in the original survey text (see Appendix B).

Tenure obtainment, research question 4, was reported by the respondents. Responses were sorted by Powe Award year. Within each Powe Award year, the responses were reported as a percentage of the total responses for that year. A lack of tenure is not necessarily due to being denied tenure, but could be due to the fact that the more recent Powe awardees had not received their evaluations for tenure when the survey was completed or were awaiting the outcome of the evaluation (Fairweather, 1999). The survey used to collect the data for this study only asked for tenure as a yes or no question. It failed to provide a "not yet eligible" or "not yet evaluated" for tenure option. It also failed to identify that received tenure at one university, but then hold a position at another university without tenure. As a result, an adjusted percentage of tenure obtainment that removes the awardees with five or fewer years since receiving their Powe Award is presented, since these respondents are most likely to not have received a tenure review.

Research question 5 addresses the consistent employment of Powe awardees at the institution where they received their Powe Award. The number of awardees maintaining constant employment with their employers is determined by comparing each survey respondent's employment history with the university where the Powe Award was given. If the awardee has maintained the same university as their employer since they received the Powe Award, then the awardee is considered consistently employed. This removes false positives for those who leave and later return to their original university. The frequency of those consistently employed and

not consistently employed awardees is reported via Powe Award year and also as an aggregate percentage of the population over all Powe Award years. This corresponds to the ways faculty attrition has been reported in the literature (Kaminski & Gleiser, 2012; Nagakowski, 2006).

The measure for leadership positions, research question 6, is reported with frequency of survey respondents by Powe Award year. These positions represent those most commonly perceived as leadership positions or professional service, and positions were reported separately as different positions carry various levels of prestige. Regardless of prestige, these positions serve important functions in a university or in support of a STEM discipline. Leadership positions reported in the data set include; for example, positions like department chair, endowed chair, professional journal editor, or an officer position within a professional association.

Qualitative Analysis

The survey contained two open-ended questions that were analyzed to answer research question 7. The first question asked the respondent to indicate if and how the respondent had continued research begun with their Powe award. The second open-ended question asked the respondent to indicate how the Powe award contributed to his/her professional growth.

The responses to these questions were analyzed through a coding method presented by John Creswell (1998). The qualitative data are reviewed for a theme contained in each statement. More than one theme may be contained per response. The identified themes are assigned individual codes, which consist of a descriptive word or short phrase. If possible, the analysis uses the same codes throughout the process. Creswell proposes not exceeding 25 – 30 codes on the initial pass through the qualitative data. Additional passes through the data should reduce a data set to five to six codes and thus five to six themes. The themes are the outcomes for research question 7.

Chapter 4

Results

This chapter summarizes the descriptive and qualitative analyses used to answer the research questions and describe the research and career outcomes of the Powe awardees. Results of the study are presented by research question. The number of respondents (N) from the survey data set is 258. No survey questions were required to be answered, thus the number of respondents (*n*) who completed the survey questions used for the analysis are reported with all results.

Research Question 1

To what extent do Powe awardees present their research or publish research results in peer reviewed articles over two academic years (2009-2010 and 2010-2011)?

Respondents to the survey of Powe Award winners were asked for the number of publications and presentations they authored or co-authored during two academic years. The academic years reported (2009-2010 and 2010-2011) were selected since they were the two complete academic years prior to the administration of the survey (February, 2012). The responses were sorted by Powe Award year and within each award year, the responses were classified by research intensive universities and non-research intensive institutions. Research intensive universities is a classification of the Carnegie Foundation (2014) that represents institutions who place a high value on publications and presentations of research as evidenced through their promotion and tenure practices. The non-research intensive institutions include universities focused on instruction and non-academic institutions, such as federal laboratories and private companies. The number of responses in each category is shown in Table 8.

Table 8 - Number of Respondents by Award Year Reporting Publications and Presentations

Powe Award year	Number of respondents	Number of respondents in research intensive institutions	Number of respondents in non-research intensive institutions	Number of respondents not reporting papers or presentations
1991	1	1	0	0
1992	1	1	0	0
1993	4	2	1	1
1994	7	2	4	1
1995	9	6	3	0
1996	9	5	4	0
1997	10	6	3	1
1998	10	4	6	0
1999	11	7	4	0
2000	15	11	3	1
2001	10	7	3	0
2002	14	11	1	2
2003	15	9	5	1
2004	15	11	4	0
2005	18	16	1	1
2006	10	10	0	0
2007	18	16	2	0
2008	22	21	1	0
2009	20	19	1	0
2010	21	19	0	2
2011	18	16	1	1
Total	258	200	47	11

Mean and median values for the data within each Powe Year and type of institution were calculated. Analysis for publications is restricted to peer-reviewed articles. Other publication types are listed in Appendix C. Publication and presentation results are shown in Tables 9 and 11 for research intensive institutions and Tables 10 and 12 for non-research intensive institutions.

Across all Powe Award years, there were 200 respondents from research intensive institutions and 47 respondents from non-research intensive institutions reporting the number of peer-reviewed publications (Tables 21 and 22 in Appendix C) and presentations (Tables 23 and 24 in Appendix C) over the previous two academic years. The remaining 11 respondents of the total 258 survey respondents did not indicate their current position to be able to assign them to a research or non-research intensive institution.

Peer Reviewed Publications. Peer-reviewed publications were reported by the survey respondents over the two academic years 2009-2010 and 2010-2011. The total number of peer-reviewed publications was 1,758 from research intensive institution respondents and 409 from non-research intensive institution respondents. The mean number of publications was $M = 8.8$ ($SD = 8.8$) for research intensive institutions and $M = 8.7$ ($SD = 8.8$) for non-research intensive institutions. The median number of publications is $Mdn = 6$ for both research intensive institutions and non-research intensive institutions.

The number of peer-reviewed publications at research intensive institutions exhibited a pattern of increase during the early career years as these faculty members sought tenure and promotion at their universities. The increase is exhibited in the mean number of peer-reviewed publications which represents the number of papers over the past two academic years per Powe awardee from that Powe Award year. From 2006 to 2011 the mean number of papers rises toward 10 papers. From 2005 through 1998, the average fluctuates between 10 and 17 papers

while 2004 was a fluctuation very low to 6.7 papers. From 1997 to 1991 reflects decreases below the average of 10 papers with a jump to 25 in 1992. However, during the same time period of 1997 through 1991, the number of respondents each Powe Award year is low (below 10) and allows for large fluctuations in the results. The pattern exhibited by the peer-reviewed publications is an increase across the years followed by a decrease.

The median values of the peer reviewed publications do not exhibit the same pattern as the mean values for research intensive institutions fluctuating between 4 and 9 with fluctuations above 10 in 1992, 1998, and 2002. For non-research intensive institutions, the median values fluctuate between 1.5 and 15. The standard deviation values associated with the mean values indicate a high amount of variance in the reported values. In six of the 21 Powe Award years for research intensive institutions, the standard deviation equals or exceeds the mean. This occurs in 1994 (M = 1.55 and SD = 1.5), 1995 (M = 5.2 and SD = 5.4), 1999 (M = 12.6 and SD = 15.0), 2001 (M = 17.0 and SD = 19.9), 2003 (M = 10.7 and SD = 11.5), and 2011 (M = 6.5 and SD = 8.5). In four of the 21 Powe Award years for non-research intensive institutions, the standard deviation equals or exceeds the mean. This occurs in 1994 (M = 3.3 and SD = 4.1), 1995 (M = 6.0 and SD = 8.5), 1996 (M = 16.3 and SD = 17.0), and 1998 (M = 9.0 and SD = 9.7).

The non-research intensive institutions mean number of peer-reviewed publications do not exhibit a set pattern as the values fluctuate across the entire 21 years of Powe awardee survey respondents in the data set. The fluctuations reflect the low number of respondents, none higher than 6, in each Powe Award year.

Research Presentations. Survey respondents reported the total number of presentations given at professional conferences and any venue outside of their institution (i.e., seminars or symposia) during the two academic years 2009-2010 and 2010-2011. The total number of

research presentations was 2,428 from research intensive institution respondents and 543 from non-research intensive respondents. The mean number of presentations was $M = 12.1$ for research intensive institutions and $M = 11.6$ for non-research intensive institutions. The median number of presentations was $Mdn = 8$ for research intensive institutions and $Mdn = 10$ for non-research institutions.

The pattern exhibited in the data for presentations from Powe awardees at research intensive institutions is similar to that for peer-reviewed publications. From 2011 to 2009, the mean number of presentations increases toward a value of 10 presentations over the previous two academic years. The next 11 years from 1998 through 2008 had mean values over 10 with one exception of 2004 where the value slipped below 10 and 2001when the mean jumped to over 30. From 1991 through 1997, the mean value of presentations fell below 10. As with the peer-reviewed publications, an increase is seen in the beginning of the faculty career to a level of productivity with a decrease towards the end of the timeframe of this population.

The Powe awardees at non-research intensive institutions do not exhibit the same pattern as their counterparts at research intensive institutions. No pattern emerges from the data. The mean values fluctuate which reflect the low respondent numbers across Powe Award years.

Clustered Results. Given the low number of respondents in the years across the Powe Award years, individual year results are vulnerable to fluctuations due to over-performers or underperformers. Thus, the grouping of Powe Award years can potentially smooth the fluctuations and provide a better view of the data. The grouping is not done to simply normalize the numbers of respondents, but represents milestones in the career trajectory of faculty members resulting in three career stages.

The first six years after the Powe Award is a period when Powe awardees are pursuing tenure and promotion to the associate professor rank (Trower, 2012). The first cluster is defined as participants from Powe Award years 2006 through 2011 and will be referred to as the young career cluster. The next eight years, 1998 to 2005, represent those Powe awardees pursuing promotion to the rank of full professor and will be called the middle career cluster. The final seven years of the Powe Award data set, 1991 through 1997, are referred to as "late career" stage because this group have most likely been promoted to full professor and occupying leadership positions.

For Powe awardees at research intensive institutions, the Powe awardees in the early career stage produced $M = 7.2$, $SD = 6.0$, and $Mdn = 6$ peer reviewed publications. The middle career stage has $M = 11.8$, $SD = 11.3$, and $Mdn = 8$. The late career stage has $M = 5.6$, $SD = 6.1$, and $Mdn = 4$. At non-research intensive institutions, Powe awardees in the early career stage produced $M = 10.2$, $SD = 5.8$, and $Mdn = 10$ peer reviewed publications. The middle career stage has $M = 9.1$, $SD = 5.8$, and $Mdn = 9$. The late career stage has $M = 7.5$, $SD = 11.2$, and $Mdn = 4$.

For Powe awardees at research intensive institutions, the Powe awardees in the early career stage produced $M = 12.0$, $SD = 11.8$, and $Mdn = 9$ presentations on their research. The middle career stage has $M = 14.6$, $SD = 19.1$, and $Mdn = 10$. The late career stage has $M = 4.7$, $SD = 5.6$, and $Mdn = 4$. At non-research intensive institutions, Powe awardees in the early career stage produced $M = 9.0$, $SD = 6.7$, and $Mdn = 6$ presentations. The middle career stage has $M = 13.8$, $SD = 10.5$, and $Mdn = 11$. The late career stage has $M = 8.4$, $SD = 9.8$, and $Mdn = 2$.

The data for the peer-reviewed publications and presentations from research intensive institutions show an increase in the mean and median values from the young career to middle career stages with a decrease to the late career stages (Tables 9 and 11). For non-research

intensive institutions, the peer-reviewed publications show a steady decrease in the mean and median from the young to middle to late career stages. However, the mean and median number of presentations at non-research intensive institutions increases from young to middle career stages but decreases to the late career stage (Tables 10 and 12).

For the late career stage presentations and peer-reviewed publications at both research intensive (publications: $M = 5.6$ and $SD = 6.1$ and presentations: $M = 4.7$ and $SD = 5.6$) and non-research intensive institutions (publications: $M = 7.5$ and $SD = 11.2$ and presentations: $M = 8.4$ and $SD = 9.8$), the standard deviation data are larger than the mean indicating a large variance in the values. The middle and early career stages have standard deviation values data nearly equal to the mean value data, except for presentations at non-research intensive institutions where the standard deviation exceeds the mean value. The relatively large values of the standard deviation and thus variance, indicates a large range values for peer-reviewed publications and research presentations.

Powe awardees are most productive in terms of peer-reviewed publications during the middle career stage both at research intensive and non-research intensive institutions. The awardees at research institutions present their research most often during the early career stage with a slight decrease when transitioned to the middle career stage. However, given the large standard deviations relative to the means ($M = 10.2$ and $SD = 5.8$ for early career stage and $M = 9.1$ and $SD = 7.6$ for middle career stage), it is difficult to conclude with certainty that the increase occurs over the larger population of Powe awardees and not just within the data set of 258 awardees.

Table 9 – Peer reviewed publications from Powe Awardees at research intensive institutions by career stage

Career Stage	Number of respondents	Sum of publications	Minimum number of publications	Maximum number of publications	Mean number of publications	Standard deviation of publications	Median number of publications
Early	101	730	0	31	7.2	6.0	6
Middle	76	899	0	60	11.8	11.3	8
Late	23	129	0	25	5.6	6.1	4

Table 10 - Presentations from Powe Awardees at research intensive institutions by career stage

Career stage	Number of respondents	Sum of presentations	Minimum number of presentations	Maximum number of presentations	Mean number of presentations	Standard deviation of presentations	Median number of presentations
Early	101	1,212	0	57	12.0	11.8	9
Middle	76	1,107	0	152	14.6	19.1	10
Late	23	109	0	20	4.7	5.6	4

Table 11 – Peer reviewed publications from Powe awardees at non-research intensive institutions by career stage

Career stage	Number of respondents	Sum of publications	Minimum number of publications	Maximum number of publications	Mean number of publications	Standard deviation of publications	Median number of publications
Early	5	51	2	18	10.2	5.8	10
Middle	27	246	0	29	9.1	7.6	9
Late	15	112	0	45	7.5	11.2	4

Table 12 - Presentations from Powe awardees at non-research intensive institutions by career stage

Career stage	Number of respondents	Sum of presentations	Minimum number of presentations	Maximum number of presentations	Mean number of presentations	Standard deviation of presentations	Median number of presentations
Early	5	45	1	17	9.0	6.7	6
Middle	27	372	0	40	13.8	10.5	11
Late	15	126	0	29	8.4	9.8	2

Other Types of Research Publications. Tables 25–28 in Appendix C contains tables for all peer-reviewed and non-peer reviewed publications collected in the Powe awardee survey, including textbooks and books based on research results. After peer-reviewed publications, survey respondents indicated they published conference papers and chapters in edited volumes most frequently over the academic years 2009-2010 and 2010-2011. This was followed by Powe awardees serving as editors or co-editors of edited volumes. Powe awardees reported authoring or co-authoring six textbooks and nine books related to research. Those Powe awardees at research intensive institutions outperform the Powe awardees at non-research intensive institutions in terms of publishing.

Research Question 2

To what extent do Powe awardees receive research grants in excess of $10,000?

The survey asked respondents to report the number of research grants they received since their highest degree to support their research. The respondents reported the number of grants received from a variety of federal science and technology funding agencies, professional associations, private foundations, or local/state governments. It is assumed that the responses represent all grants over the entire faculty career of the Powe awardees since eligibility of the Powe Award covers the first two years of their first tenure-track faculty position.

The results are sorted first by the Year of the Powe Award and then by the type of institution, research intensive and non-research intensive. This sorting procedure used is the same as that utilized for research question number one, because the requirements for research productivity differ at research intensive institutions and non-research intensive institutions. Therefore, these two groups are separated in the data analysis. The grant data for survey respondents currently at research intensive institutions are shown in Table 29 (in Appendix C) and in Table 30 (in Appendix C) for those respondents who are currently at non-research

intensive institutions.

Number of Grants Awarded. A total of 246 survey respondents provided information on grants. It was determined that 199 held current positions at research intensive universities (Table 29 in Appendix C) and 47 at non-research intensive institutions (Table 30 in Appendix C). The total number of grants for all survey respondents was 1,866 with 1,416 reported by those at research intensive universities and 450 awarded to those at non-research intensive institutions. For research intensive universities, the mean number of grants was $M = 9.6$, median was $Mdn = 8$, and standard deviation $SD = 7.7$. For non-research intensive institutions, the mean number of grant was $M = 7.2$, median was $Mdn = 6$, and standard deviation $SD = 6.7$. The Powe awardees from research intensive institutions reported earning more grants over their careers on average than those at non-research intensive institutions. The standard deviation values are large enough to show a non-negligible amount of variance exists between the Powe awardees. While differences are expected across Powe Award years because as the "career age" increases or the number since Powe Award increases, there is more time to apply for grants. However, variations within the same Powe Award year are more difficult to explain with a possible combination of discipline and individual variables contributing to the variance.

An overall pattern can be observed: an increasing mean of total number of grants earned per respondent from research intensive universities as the time from Powe Award until the survey date in February 2012 increases. The pattern loses consistency with the very early years of the Powe Award, due to the low number of respondents in those Powe Award years. The same pattern emerges in the median values of total grants earned.

The Powe awardees at non-research intensive institutions do not exhibit the same pattern as those at research intensive institutions. No pattern emerges from the data. The mean values fluctuate, reflecting the low responses across the Powe Award years.

Clustered Results. As with the publications, the low number of respondents across the Powe Award years, year to year results are vulnerable to fluctuations due to over-performers or underperformers in the different Powe Award years. Thus, Powe Award years were clustered to attempt to smooth the fluctuations and provide a better view of the data. However, the grouping is not done to simply to normalize the numbers of respondents, but it represents milestones in the career trajectory of faculty members. The same grouping used for publications and presentations with the Powe Award years 2006 – 2011 being designated the early career cluster, years 1998-2005 as the middle career cluster, and years 1991-1997 as the late career cluster.

When the results of the clusters are examined a pattern is evident. Table 13 shows the grants obtained by Powe awardees for research intensive institutions and Table 14 shows the grants obtained by Powe awardees at non-research intensitve institutions. For research intensive institutions, the early career stage (Powe Award years 2006 – 2011) group has a total of 457 grants for n = 100 awardees ranging from 0 to 18 grants with M = 4.6, *S.D.* = 3.7, and Mdn = 3.5. The middle career stage (Powe Award years 1998 – 2005) has a total of 740 grants for n = 76 awardees ranging from 0 to 45 with M = 9.7, *S.D.* = 8.0, and Mdn = 8. The later career stage (Powe Award years 1991 – 1997) has a total of 235 grants for n = 23 awardees ranging from 0 to 27 with M = 10.2, *S.D.* = 7.3, and Mdn = 9. Both the mean and median of grants for the career stages increase from early to middle to late, which indicate that the Powe awardees earn more

Table 13 – Grant obtainment reported by Powe Awardees at research intensive institutions by career stage

Career Stage	Number of respondents	Sum of grants	Minimum number of grants	Maximum number of grants	Mean number of grants	Standard deviation of grants	Median number of grants
Early	100	457	0	18	4.6	3.7	3.5
Middle	76	740	0	45	9.7	8.0	8
Late	23	235	0	27	10.2	7.3	9
Total	199	1416	0	45	7.2	6.7	6

Table 14 – Grant obtainment reported by Powe Awardees at research intensive institutions by career stage

Career stage	Number of respondents	Sum of presentations	Minimum number of presentations	Maximum number of presentations	Mean number of presentations	Standard deviation of presentations	Median number of presentations
Early	5	24	1	7	4.8	2.4	6
Middle	27	221	0	24	8.2	6.8	7
Late	15	205	0	35	13.7	8.5	11
Total	47	450	0	35	9.6	7.7	8

grants, as they advance through the stages of their careers. The increase from early stage to middle stage is larger than the increase from middle to late stage. This corresponds to the tenure and promotion activities within the career stages. During the early career stage, faculty members are establishing their research agendas to achieve tenure and promotion to associate professor. The middle career stage represents faculty members who continue their research agendas and seek promotion to full professor leading to an increase in the number of grants earned. In the late career stage, faculty members have achieved full professor status and may continue their research, but they may also have moved into administrative or leadership positions in the university.

For non-research intensive institutions, the early career stage (Powe Award years 2006 – 2011) group has a total of 24 grants for $n = 5$ awardees ranging from 1 to 7 grants with $M = 4.8$, $S.D. = 2.4$, and $Mdn = 6$. The middle career stage (Powe Award years 1998 – 2005) has a total of 221 grants for $n = 27$ awardees ranging from 0 to 24 with $M = 8.2$, $S.D. = 6.8$, and $Mdn = 7$. The later career stage (Powe Award years 1991 – 1997) has a total of 205 grants for $n = 15$ awardees ranging from 0 to 35 with $M = 13.7$, $S.D. = 8.5$, and $Mdn = 11$. Both the mean and median total grants for the career stages increase from early to middle to late, which indicates that the Powe awardees earn more grants as they advance in the stages of their careers. The increase from early stage to middle stage is larger than the increase from middle to late stage. While the means and medians of the early and late career stages exceed the corresponding values for research intensive, the number of responses for the non-research intensive career stages are too low to allow comparisons to the same career stages for the research intensive institutions.

Source of Grants Awarded. The source that awarded the greatest number of grants to Powe awardees (Tables 31 and 32 in Appendix C) was the National Science Foundation with a total of 516 grants. The institution or employer of the Powe awardees was the second largest source of grants with a total of 260 grants followed by the Department of Defense awarding 221 total grants to Powe awardees. Private foundations awarded 161 grants and the National Institutes of Health awarded 141 grants to Powe awardees.

Size of Grant. The Powe awardees were asked for the largest grant that had been received at the time of the survey. Of the 258 respondents, 217 reported the funding source, program name, size of the grant, year of the award, and duration of the award. The responses ranged from the lowest grant of $10,000 from the Powe Award to the two largest grants of $14,000,000 for an NSF Center for the Environmental Implications of NanoTechnology and $78,000,000 for an NSF Materials Research Science & Engineering Center grant. The sum of the largest grant amounts was $282,940,648 resulting in an average award of $1,303,874 per question respondent. The average duration of the largest grants was more than four years but less than five years.

Research Question 3

To what extent have Powe awardees received awards for research other than grants?

The Powe awardee survey asked, since receiving their highest degree if they received any honorary recognitions or awards (not research grants) honoring their research (Table 15). Survey respondents who had received an award were asked to identify the source of the award. The responses are shown by Powe Award year in Table 33 in Appendix C.

Of the 258 survey responses, 233 Powe awardees responded that they did or did not receive an honorary awad recognizing their research. Of the 233 responses to this question, 114 or 48.9% respondents indicated that they earned an honorary award. The most awards were

Table 15 - Powe Awardees Reporting Information on Honorary Awards Recognizing their Research

Powe Award year	Number of respondents	Number of respondents earning an award	Number of respondents not earning an award	No response given	Percent of respondents reporting earning an award
1991	1	0	1	0	0.0%
1992	1	1	0	0	100.0%
1993	4	3	1	0	75.0%
1994	7	1	3	3	25.0%
1995	9	5	3	1	62.5%
1996	9	5	4	0	55.6%
1997	10	4	5	1	44.4%
1998	10	8	2	0	80.0%
1999	11	6	3	2	66.7%
2000	15	6	7	2	46.2%
2001	10	7	3	0	70.0%
2002	14	7	5	2	58.3%
2003	15	9	6	0	60.0%
2004	15	6	7	2	46.2%
2005	18	7	10	1	41.2%
2006	10	4	5	1	44.4%
2007	18	10	6	2	62.5%
2008	22	6	16	0	27.3%
2009	20	9	8	3	52.9%
2010	21	6	12	3	33.3%
2011	18	4	12	2	25.0%
Total	258	114	119	25	48.9%

received from the respondent's institution or employer (n = 61), a national professional association (n = 44), and the National Science Foundation (n = 20). There were no awards received by respondents from the NIST, NOAA, and DoEd. A total of 31 respondents indicated that they received an award from a source not listed, but identified as "Other". The sources of the "Other" category include the institutions of employment of the Powe awardee, their home country (e.g., Japan), and university alumni groups. There were no patterns and no single source of awards that distinguished themselves.

Research Question 4

To what extent do Powe awardees obtain tenure?

Powe Awardees were asked if they were currently tenured or had ever been tenured. The respondents indicated Yes or No. The respondents also indicated the number of years and months from acceptance of a tenure track position until they received tenure. The results from the survey are shown in Table 16.

Of the 258 survey responses, 248 reported receiving or not receiving tenure. A total of 156 or 62.9 percent of survey respondents reported currently having or previously receiving tenure. There were no respondents from the 2010 or 2011 Powe Award years and only one respondent from the 2009 class that reported receiving tenure. All members of the 1991, 1992, 1993, 1995, and 1996 Powe Award reported receiving tenure.

Trower (2012) indicates that it is unlikely that Powe Awardees who are five to six years from beginning their faculty appointment have been evaluated for tenure. Thus, the results for this research question looking at tenure obtainment should be adjusted to preclude those who received their Powe Award from 2007 through 2011. While this adjustment eliminated 16 Powe awardees who were awarded tenure earlier than the normal timeframe for the professoriate, it removed 81 who had not received tenure and most likely not received a tenure evaluation at the

Table 16 - Tenure Obtainment of Powe Award Survey Respondents

Powe Award year	Number of respondents	Tenured	Not tenured	Not reported	Percent tenured	Average time to tenure (years)
1991	1	1	0	0	100.0%	5.50
1992	1	1	0	0	100.0%	6.00
1993	4	4	0	0	100.0%	4.22
1994	7	4	1	2	57.1%	4.50
1995	9	9	0	0	100.0%	5.98
1996	9	9	0	0	100.0%	6.33
1997	10	7	2	1	70.0%	6.74
1998	10	9	1	0	90.0%	5.53
1999	11	10	0	1	90.9%	5.98
2000	15	14	0	1	93.3%	5.66
2001	10	10	0	0	100.0%	5.38
2002	14	11	1	2	78.6%	5.45
2003	15	14	1	0	93.3%	5.70
2004	15	14	1	0	93.3%	5.82
2005	18	14	3	1	77.8%	6.15
2006	10	9	1	0	90.0%	5.70
2007	18	12	6	0	66.7%	4.84
2008	22	3	19	0	13.6%	5.17
2009	20	1	19	0	5.0%	3.42
2010	21	0	19	2	0.0%	-
2011	18	0	18	0	0.0%	-
Total	258	156	92	10	62.9%	5.67

time of the survey. With the adjusted population of Powe awardees from 1991 through 2006, there are 140 Powe awardees who received tenure from a total of 159 survey respondents, or 88.1 percent of survey respondents who most likely received a tenure evaluation.

The 156 respondents who indicated that they had received tenure also reported receiving it on average 5.67 years after accepting their tenure track position. The range of reported time to tenure was 0.5 years to 12 years. Using the same adjustment to remove the 2007-2011 respondents, the average time to tenure is 5.04 years.

Research Question 5

To what extent have Powe awardees held continuous employment at the original institution of the award?

The Powe awardee survey asked respondents to list all positions they held after finishing their education, including postdoctoral positions. The listing of positions was used to determine if the respondent held continuous employment at the same university from which he/she received the Powe Award. The results are displayed in Table 17.

The number of survey respondents who reported an employment history enabling determination of continuous employment was 245 of the 258 total survey respondents. A total of 191 or 78.0 percent of survey respondents reporting an employment history held continuous employment at their original universities. There were a total of 54 survey respondents who reported a change in employer to another institution since the time of their award or who held a position at another institution before returning to the institution where they received their Powe Award.

The Powe awardees held continuous employment at the institution of their Powe Award in great numbers except for an anomalous decline in the percent of faculty holding continuous employment in 2003. The percentage stays above 70% until the 2000 Powe Award Year. The

Table 17 - Results of Employment History Analysis for Continuous Employment

Powe Award year	Number of respondents	Held continuous employment	Not continuously employed	History of positions not reported	Percent of respondents holding continuous employment[a]
1991	1	1	0	0	100.0%
1992	1	1	0	0	100.0%
1993	4	1	2	1	33.3%
1994	7	2	4	1	33.3%
1995	9	6	3	0	66.7%
1996	9	5	4	0	55.6%
1997	10	5	4	1	55.6%
1998	10	4	6	0	40.0%
1999	11	7	4	0	63.6%
2000	15	10	3	2	76.9%
2001	10	7	3	0	70.0%
2002	14	10	2	2	83.3%
2003	15	8	6	1	57.1%
2004	15	11	4	0	73.3%
2005	18	15	2	1	88.2%
2006	10	9	0	1	100.0%
2007	18	15	3	0	83.3%
2008	22	20	2	0	90.09%
2009	20	29	1	0	95.0%
2010	21	29	0	2	100.0%
2011	18	16	1	1	94.1%
Total	258	191	54	13	78.0%

[a]The percentage of respondents holding continuous employment is calculated as the number of respondents holding continuous employment divided by the sum of those holding continuous employment and those not holding continuous employment. The sum excludes those not reporting an employment history.

Powe awardees from 1991 through 1999 have a decreasing pattern of continuous employment as the time elapsed from the Powe Award increases. However, there are a number of years with a low number of respondents, indicating that the results in those years could be due to extreme underperformers or overachievers.

Research Question 6

To what extent have Powe awardees assumed positions of leadership in universities and research communities?

The Powe awardees responded to a series of questions describing various roles contributing to research that they could hold at the university level or across universities through a funding agency or professional society. At the university level, the roles span from chair of a dissertation committee to department chair to President or Chancellor of the university. With regard to leadership beyond the university, respondents were asked if they had served on peer review committees or in a position such as editor or reviewer for a research journal. These lists were not meant to be exhaustive of the possible positions researchers might hold over their careers. The responses are listed in Tables 34-36 in Appendix C

The position most often reported by the responding Powe awardees was service as a reviewer for a peer-reviewed journal (87.6%). The second most reported position was member of a National Science Foundation (NSF) review panel or committee (65.9%). The next most common activities were serving as chairperson of a dissertation committee (56.2%), serving on a government funding agency review panel other than NSF (51.6%), serving on a professional association committee (38.0%), and serving as editor of a peer-reviewed journal (32.9%). The rest of the positions reported received responses of fewer than 33% of survey respondents.

Over a maximum of a 21-year career as a faculty member, the Powe awardees have had one person who has been appointed to a Chancellor, Vice President or President position within a

university; two awardees have served in a Dean or Provost position, and three awardees have served as an Associate Dean or Associate Provost.

Research Question 7

To what extent do Powe awardees perceive the Powe Award influenced their careers?

The data for research question 7 is taken from two open-ended survey questions in the dataset. Powe awardees were asked how they sustained the research activities implemented as part of the Powe award. Comments were given by 132 of the 258 respondents. No comments were received by 125 survey respondents. The second open ended question asked the respondents to describe in their own words what the Powe Award has meant to their professional development, both positively and negatively. Comments were given by 139 of the 258 total survey respondents. No comments were received from 119 survey respondents. The text from the open-ended responses was analyzed for themes (see Chapter 3 for methods). The themes and example responses are provided below.

Sustained Research

Powe awardees reported three main themes that sustained their research proposed in the Powe Award application beyond the duration of the Powe Award. The overwhelming majority of responses to the “professional development” question comments was positive and indicated a positive impact on the career of the survey respondent. There are twenty responses that were non-informative or did not address the question posed. For example, one respondent stated “Overall, the Powe award impacted my professional development very positively by provide unrestrained funds for my research projects.” While this response is positive, it does not give insights into how the Powe Award funds were used or the outcome of the Powe Award funded research.

The most common theme in the responses was “follow-on funding” as identified in 62 of the 132 responses. This theme represents comments made by survey respondents who used their Powe funding to obtain more funding to support the continuation of the research begun with Powe funds. Responses referred to the preliminary data used in research grant proposals after the Powe Award that extended the research line. One participant commented:

> …the Powe award was vital to my early career research activities, as I received only $5K in start-up funds the first year of my tenure-track appointment. Those activities that the Powe award helped me initiate continue to this day, and those preliminary results helped me obtain my first NSF grant.

The NSF is not the only source of funding that Powe awardees obtained to continue the research begun with Powe Award funds. In addition to the federal agencies, awardees also reported industry as a source of funding in addition to other federal agencies as sources of research funding:

> I have continued to develop the concepts and methods proposed for the Powe award for flow of very concentrated suspensions, with experiments and theory supporting bulk flow models, supported by industry as well as federal agencies.

Powe awardees have received further research funds from the NIH, DOE, NASA, state agencies, private foundations, and their institutions. Not all respondents indicated the sources of the funding they received after the Powe Award. For example, one survey respondent indicated a very positive outcome, but did not identify the source, “I have continued my research focused on … eventually leading to successful national funding and granting of tenure. The award was looked on very favorably by the administration here at my institution.”

Four awardees identified publications as a result of the Powe funded research. Publications are an important indication of success for young faculty (Laudel, 2006), demonstrating their ability to compete for funding, perform the research, and publish the results. Program officers and peer reviewers will have confidence in the awardee to repeat this process in future research. The results of publications from Powe funded research can support future grant proposals through data and proof of concepts.

Eight of the 62 responses that discussed further research funding mentioned that the data from the Powe funded project were the preliminary data used in a winning NSF CAREER Award proposal, “the Powe Award helped with seed funding for winning a prestigious NSF Career Award, helping me to gain compelling preliminary results for my NSF proposals.”

The second major theme identified from the survey responses was that the line of research funded by Powe has been continued beyond the duration of the Powe Award. Forty-four respondents indicated that the research in the Powe Award application or a derivative of that research was being pursued at the time of the survey. One awardee stated, “I continue to do research and write papers in the area. Obviously, the grant gave me the opportunity to lay the foundation needed for these continuing activities.” This sentiment is reinforced multiple times. For example, another awardee reported, “started my work with photovoltaics which became one on the primary focus areas of my professional career, over nearly the last 20 years.”

Six of the awardees who identified sustained research that began with their Powe Awards identified equipment purchased with award funds as the lasting influence. For example, one awardee responded, “It started my independent career in oxide surfaces. I purchased a piece of equipment and software I am still using today.” Another awardee responded that “much of the

award was used to purchase equipment which I still use on a regular basis." Both respondents indicated that the equipment was in use for over 15 years in their respective laboratories.

The third major theme identified by survey respondents in regard to sustaining the research begun with a Powe Award was the support of graduate students. Nine respondents indicated that they supported graduate students with the Powe Award funds. The graduate students sustained the research by disseminating results through an additional form, the dissertation or thesis of the graduate student. One Powe awardee indicated, "The work under my Powe award led to the dissertation topic for my first PhD student, who has now graduated." Another Powe awardee reported that the graduate student was about to graduate and had published "4 peer-reviewed publications" on the research from the Powe Award. Thus, the funds from the Powe Award can directly assist the careers of more than just the awardee.

Perceived impact of Powe Award

Survey respondents provided a total of 139 comments to the open-ended question asking what the Powe Award meant to their professional development. As described in Chapter Three, the text responses were grouped into themes that encompass similar responses. A survey response could be assigned to more than one theme.

The theme that appeared most often in the 139 responses was confidence. The confidence gained by Powe awardees was cited specifically 35 times. The word confidence was used specifically by the respondents and was grouped with responses from those that referred to encouragement, positive motivation, or a moral boost. The respondents replied that their confidence was boosted with respect to some aspect of their career at that time.

A number of the responses referred to the Powe Award as the first competitive grant or award that they won and that resulted in the confidence gain. One respondent replied, "It was the

first external grant that I received. It made a big difference to my confidence as a newly independent researcher." Another response stated:

> It was the first competitive grant I wrote and subsequently received. In fact, I wrote it during the first week of taking this position. Receiving the award and the recognition that came with it was valuable in moving forward. It gave me that feeling of, I can do this, which is invaluable.

While this awardee gained confidence in the ability to become an independent researcher, there were others that received validation of the ideas in their research agenda. This response illustrates this type of confidence gain:

> The Powe award was the first research funding that I received after obtaining an independent position. As such, it increased my confidence regarding the significance and scientific novelty of our work. This encouraged me to submit more grant applications…

The peer review of the Powe Award applications provided the awardees with a sense of validation by their scientific peers. It is best illustrated in the response from this awardee, "The award was a sign to my colleagues that a neutral group of outside scientists saw value in my work, enough to support it directly."

Thirteen of the 35 awardees who identified confidence gains from the Powe Award made specific reference to their ability to write and win research grants. One awardee credited the gain in confidence from the Powe Award because of "some initial rejections" received in response to grant proposals. A second awardee stated,

> Early on, when my confidence in writing grant proposals was very, very low, the reviewers' comments and the receipt of the award were positive feedback that encouraged me to try for more and believe in my a) research area, and b) efforts.

The second most popular theme was recognition appearing in the comments from 33 survey respondents. The recognitions that Powe awardees signified as meaningful were at the department level and within the administration of the university. One respondent indicated that the research of the awardee was viewed "more favorably by my senior collegues." Another survey respondent indicated that the Powe Award brought positive attention to the awardee's research at the local university level and beyond, "it was a very positive experience for me to garner some national/regional attention to my research activities that was recognized by the higher administration and by my departmental colleagues."

The third most popular theme was a tie of two themes each receiving 15 comments. One theme was the creation of a new research line and the second was obtaining future funding. The obtainment of future funding is a theme that also appeared in the question about sustainment of the research funded by the Powe Award. The funds from the Powe Award were used to collect preliminary data to indicate the potential for success in a research grant proposal. One respondent stated that the Powe Award "served as seed funding for future projects up to 800,000 USD", which is 80 times larger than the initial investment of the Powe Award. Another Powe awardee indicated that it was not the preliminary data, but credibility added to his resume, that helped obtain the academic credibility to be a successful research PI, "I used that award to leverage internal resources and to build my credibility on external grant applications. Since then I have received several large grants which have enabled a successful research career." One

survey respondent indicated that the Powe Award was the catalysis for obtaining subsequent funding and that led to obtaining tenure:

> [The Powe Award] helped me get over the hurdle of receiving my first grant as PI, which then led to follow-up funding from NSF, which was a huge factor in getting tenure. The Powe award was the first in a chain of events that help [*sic*] me be a successful professor. Without this first link in the chain, I'm not sure how my career would have developed. This was a very important award to me!

The ability to pursue a new research line is often not possible for junior faculty members with limited start-up packages. One Powe awardee indicated the Powe Award, "gave the opportunity to explore one aspect of the research that otherwise was risky to undertake and develop this to a level where further support was available." The decision to pursue these new lines of research "might not have been pursued otherwise." The results of beginning a new research line can vary. This Powe awardee reported a positive outcome:

> Powe award was the very first research award and grant I received after I started my tenure track job. It allowed me to start to explore some emerging topics I was interested in, which eventually thrived into a major research topic I'm currently focusing on. The positive impact of winning the Powe award on my professional career couldn't be overstated.

The fourth most popular theme was tenure as mentioned by 13 survey respondents. One awardee reported, "the Powe [Award] was a significant award that I feel greatly assisted in the evaluation of my tenure dossier." In addition to awards, research is one of the components in the tenure decision (Trower, 2012), and the Powe Award is a peer reviewed competitive award partly based on the research proposal in the application (ORAU, 2013a). One Powe awardee

stated that the Award, “Enabled me to demonstrate the ability to attract funding, which was essential early in my career.”

The monetary portion of the award was mentioned in ten of the comments made in response to the “professional development” question. Those comments indicated that the $10,000 of the Powe Award was low compared to the cost of research in the field of the respondent. One responded stated, “The amount is very modest for people in my field, but every little bit helps.”

Two exemplar quotes of the low monetary amount of the Powe Award were perceived as having no effect on the research or career of the respondent. One of the exemplars states, “Good CV-filler, but amount was minuscule [*sic*] and thus mildly impactful at best.” Another respondent stated, “I really appreciate this award which works like an incentive/bonus for my research – what I love to do anyway.”

However, some respondents indicated the value they perceived of the Powe Award went beyond the amount of money into something intangible. One awardee stated, “The award is small compared to the monetary value of typical grants at my institution. However, it was a competitive named award, and those are considered important in the tenure decision…” This sentiment is echoed by another awardee, “Even though the dollar amount was not large, success in bringing in external funding as PI from competitive peer-reviewed sources such as Powe is a highly regarded component of the tenure evaluation process in my Department.”

Summary of Results

This study produced the first investigation of the career outcomes of Powe awardees over the first 21 years of the program. The outcomes of interest were research productivity, tenure obtainment, continued employment, leadership positions, and professional development.

The research outcomes were measured through the numbers of peer-reviewed publications and presentations over the previous two academic years, research grants obtained, and research awards (other than grants). A total of 258 responses from the original 2012 survey dataset were analyzed. From current employment data, the respondents were determined to be either from a research or non-research intensive institution. For the 235 respondents from research intensive institutions, a total of 2,146 peer-reviewed publications and 2,927 presentations were reported from the academic years 2009–2010 and 2010–2011. For the 11 respondents from non-research intensive institutions, a total of 21 peer-reviewed publications and 44 presentations were reported. The survey results contained 198 responses regarding grant obtainment from research intensive institutions, totaling 1,412 grants with the most grants coming from NSF, “my institution”, DOD, private foundations, and NIH. There were 47 responses from Powe awardees at non-research intensive institutions with a total of 427 grants with NSF, “my institution”, private foundations, DOE, and DOD as the top sources of grants. The average size of the largest grant was approximately $1.3 million with an average duration of more than 4 years, but less than 5 years. Lastly, a total of 114 Powe awardees (or 48.9%) reported receiving an honorary award other than the Powe Award recognizing their research.

The career outcomes addressed in this study were tenure obtainment, continued employment at the institution of Powe Award, and leadership positions. Powe awardees were asked if they had received tenure during their faculty career, and 156 (62.9%) responded that they had. Of those who responded that they had received tenure they did so in an average of 5.67 years. The employment history of the 258 survey respondents was analyzed, and 191 Powe awardees (78%) maintained continuous employment at the university where they received their Powe Award.

Powe awardees reported engagement in a number of leadership positions that two hundred twenty six (226) had served as reviewers for peer-reviewed journals, and 203 were review panel members for NSF and other federal agencies. At the university level, one Powe awardee had served as a chancellor, president, or vice president; two served as deans or provosts; three served as associate deans or provosts; 15 served as the director of a research center, and 14 served as assistant directors of research centers. At the department level, 145 awardees reported chairing a dissertation committee, 72 had served on a faculty search committee, and 61 reported being visiting professor at another institution.

The final research question focused on the perceived impact of the Powe Award on the careers of the survey respondents, using the analysis of the survey's open-ended questions. When asked about how the awardees had sustained the research funded with the Powe Award, the comments were grouped into three main themes: obtaining follow-on funding, sustaining of the research agenda beyond the duration of the Powe Award, and funding graduate students. The use of the Powe Award as seed money to obtain larger grants or awards such as NSF's CAREER Award was a common thread in themes 1 and 2.

When asked how the awardees perceived the role of the Powe Award in their professional development, the themes most prevalent in the comments were an increase in confidence, recognition gained, obtaining future funding, establishing a new research line, and tenure obtainment. The comments given were largely positive and emphasized the help the Powe Award gave in establishing the career of the awardee. One respondent stated,

> I can't overestimate how important it was to my career. It quite literally gave me my start. I was a National Center Director at a National Lab and now the VPR and

> Assoc. Provost at a great technical University and I can trace it all right back to my Powe award.

Another survey respondent made a statement that encapsulates the intangible results of the Powe Award, results not measured in the other research questions:

> I have established a robust and active research group. The Powe was part of that, and I am deeply grateful for that EARLY support. It is hard to state how important early support is. It gives confidence and pride to the young professor that is emotionally important. Obviously, the ability to support research is clear, but I think the spiritual boost it gives to young PIs may be under reported.

Chapter 5
Conclusions and Recommendations

Early career faculty award programs vary in the support they give to new faculty. Some programs are bridge programs, beginning their support for the awardees as postdocs, but all of the programs give financial support to university faculty at the rank of assistant professor. These programs are established based on Merton's (1968) theory later called cumulative advantage, which posits that those faculty members who have strong beginnings in their career will earn more scientific credit, gain access to greater resources (i.e., research grant), and publish more. Early career faculty award programs seek to achieve this advantage to support faculty members that further the goals of the organization offering the award. For example, the Leukemia & Lymphoma Society (Lichtman & Oakes, 2001) offers an award to researchers to pursue research in leukemia, lymphoma, and related diseases with a goal that the awardees will continue to pursue that research line beyond the end of the award period.

In 1991, ORAU established the early career faculty award program that became known as the Ralph E. Powe Junior Faculty Award in 1994. The recipients, each of whom is in the first two years of a tenure track position, receive $5,000 in "seed money" to enhance their research during the early stages of their career. Each recipient's institution must match the ORAU award with an additional $5,000, making the total prize worth $10,000 for each awardee. Winners may use the grants to purchase equipment, fund graduate or undergraduate students, or travel to professional meetings and conferences. Since the program's inception in 1991 through the 2011 awards, ORAU awarded 460 grants totaling $2.3 million. Including the matching funds from the ORAU member institutions, ORAU facilitated grants have been worth more than $4.6 million.

The purpose of this study was to investigate the research and career outcomes of Powe awardees over the first 21 years of the program by describing their research productivity, tenure obtainment, continued employment, and perceived impact on their careers. A secondary data analysis was performed on the data collected from a previously administered survey of Powe Award winners from 1991 through 2011. This chapter presents the conclusions for each research question, provides discussion for these conclusions, and discusses implications for future research.

Conclusions

Research Question 1

To what extent do Powe awardees present their research or publish research results in peer reviewed articles over two academic years (2009-2010 and 2010-2011)?

Conclusion – Powe awardees at research intensive institutions publish peer reviewed articles and present their research with increasing frequency in their early and middle career stages and subsequently decreasing frequency in the late career stage.

Conclusion – Powe awardees at non-research intensive institutions present their research with increasing frequency during the early and middle career stages and subsequently decreasing frequency during the late career stage. They publish peer reviewed articles with decreasing frequency from early to middle to late career stages.

Conclusion – Middle career stage is the most productive group for presenting research and for peer-reviewed publications for those at research intensive institutions. Respondents in the early career stage at non-research intensive institutions were the most productive group for peer-reviewed publications.

Research Question 2

To what extent do Powe awardees receive research grants in excess of $10,000?

Conclusions – Powe awardees have been successful in obtaining research funding at an increasing rate throughout their careers at both research intensive and non-research intensive institutions. Survey respondents reported a total of 1,866 grants received from several sources including federal funding agencies, private institutions, and Powe awardee institutions.

Research Question 3

To what extent have Powe awardees received awards for research that are not grants?

Conclusion – Not quite half (48.9%) of the Powe awardees who completed the survey reported receiving an award honoring their research.

Conclusion – The most common source of awards is the institution or employer of the Powe awardee. The options of national professional association, "Other" (e.g., alumni associations, country of citizenship), NSF, and private foundations were selected as sources that also recognized Powe awardees for their research work.

Research Question 4

To what extent do Powe awardees obtain tenure?

Conclusion – Approximately four out of five Powe awardees from 1991 through 2006 have obtained tenure from an academic institution and have done so, on average, in about five years.

Research Question 5

To what extent have Powe awardees held continuous employment at the original institution of the award?

Conclusion – Seventy-eight percent of Powe awardees responding to the survey maintained continuous employment at the institutions where they received their Powe Awards.

Research Question 6

To what extent have Powe awardees assumed positions of leadership in universities and research communities?

Conclusion – Powe awardees are more likely to hold positions of leadership external of the university.

Conclusion – Powe awardees held relatively few internal university leadership positions.

Research Question 7

To what extent do Powe awardees perceive the Powe Award influenced their careers?

Conclusion – Just over half of Powe awardees provide comments in the open-ended questions, 133 for the "sustaining research" question and 139 for the "professional development" question. Response from these questions were largely positive with the negative comments suggesting an increase in the monetary size of the Powe Award.

Conclusion – Some Powe awardees reported that they were able to sustain the research begun with Powe Award funds past the duration of the Award year. These Awardees were able to collect preliminary data to submit and win grants that allowed for the continuation of the Powe Award research.

Conclusion – One-quarter of awardees who provided a comment on the Powe Award report an increase in confidence as researchers and confidence to win future grants. Some also

received recognition at the departmental and university levels, and perceived that the award may have assisted in receiving tenure.

Discussion and Implications

The goal of the Powe Award program is to provide seed money for research by early career faculty at ORAU member institutions. These awards are intended to enrich the research and professional growth of early career faculty and result in new funding opportunities (ORAU, 2013a). This study illustrates that the goal is being met for 246 (95%) of the Powe awardees who responded receiving a research grant in addition to their Powe Award in the follow up survey.

The results of this study indicate that along with winning grants, some of the Powe awardees also receive the intangible benefit of confidence. This confidence is provided through feelings that their research agenda is worthy of a positive peer review and selection for the Powe Award. It is also built in their ability to win funding. The Powe Award encourages some awardees to pursue further opportunities. The open ended responses found in completed alumni surveys revealed that this boost of morale is needed for some at a time when rejections of research proposals and struggles often create what one Powe awardee calls, “the darkest days of my career.”

The purpose of this study was to investigate the career outcomes of Powe awardees over the first 21 years of the program. The results provided a description of the Powe awardees’ research and career outcomes by describing their career trajectory in terms of research productivity, tenure obtainment, and continued employment.

Seventy-eight percent (78%) of the Powe awardees held continuous employment from the institution where they received their Powe award. Of the 258 survey respondents, sixty-two (62.9%) reported receiving tenure. When the number of survey respondents was adjusted to

remove the 2007 – 2011 Powe awardees that most likely had not received a tenure evaluation, eighty-eight percent (88.1%) of those remaining (1996-2006) had received tenure.

The literature on continuation rates for faculty has focused on year-to-year continuation and not career-long continuous employment (Ehrenberg et al., 1991; Nagowski, 2006). The study by Kaminski et al. (2012) reported that 64.2% of faculty in STEM departments who entered an institution as assistant professors were promoted to associate professor at the same institution. Thus, the Powe awardees appear to outperform their peers in STEM departments. However, the Powe Award is a selective process that identifies those with professional promise from the faculty roster that Kaminski et al. considers as a whole. Therefore, a definite conclusion cannot be drawn but the longevity of the Powe awardees at their "Powe universities" is encouraging, both for awardees and the universities.

Tenure is based on research, instruction, and service (Trower, 2012). A faculty member's ability to earn external funding determines the size and extent of the research line that the faculty member can implement and execute (Ehrenberg et al., 2003). Therefore, faculty members must earn grants in order to earn tenure and promotion. Ninety-five percent of Powe awardees reported earning grants.

Results of the research funded by these grants are reported through multiple modes and two of those channels of dissemination are the oral presentation of the results of the study and publication of a peer reviewed article. This study explores the publications and presentations reported by survey respondents over the previous two academic years. At research intensive institutions, the pattern present of Powe awardee peer reviewed publications and presentations shows increases over the early and middle stages of the academic career. The late career stage

has a decreasing trend in peer reviewed publications and presentations. This pattern is not repeated among the 47 Powe awardees determined to be at non-research intensive institutions.

The literature on peer reviewed publications is well-established and extensive, but few studies have been conducted regarding the publication patterns over the career lifetime of scientists and engineers. The seminal study on this topic is Levin and Stephan (1991), which explored the productivity over the lifecycle of the academic career. They found age related effects with an increase in publications until late in the academic career and then a decrease in the publications. This is the same pattern observed in the Powe awardees' peer reviewed publications.

There is a lack of studies in the literature to give an indication of what behavior might be expected by university research faculty with respect to research awards and leadership positions. Thus, no comparisons between Powe awardees and other faculty can be made on these measures.

Implications for ORAU

This study provides some "early" information about the impact of early career awards on faculty career development, but more research is needed. This study suggests to ORAU management that the Award goals are being met. Awardees have earned 1,866 grants after receiving their Powe Award. Many of the awardees are earning tenure, holding continuous employment at their "Powe" universities, and publishing and presenting their research. There are some awardees who reported the confidence boost from the Powe Award helped them to persevere through the pressures of academia.

ORAU management can take the results of this study to make program improvements to the Powe Award program. First, the recipients are grateful to receive the award with over half of awardees providing some type of positive comment and some discuss the intangible benefits

derived from a Powe Award. There were some comments that indicated that the amount of the Award is “miniscule” and does not make an impact. From Ehrenberg et al. (2003), the size of start-up packages for faculty provide much more than the $10,000 Powe Award prize. Thus, it is suggested that ORAU could increase the size of the Pow Award to provide greater impact to the research being performed by the awardees. There is no optimal size of an early career award

Implementing an annual tracking effort could increase the response rate future follow up surveys and studies. The tracking effort could be reduced in future years by a smaller investment on an annual basis. The inability to contact and receive survey responses from Powe awardees in the earliest years was evident in this study. For example, 1991 and 1992 each had one response.

This study also suggests that ORAU should revise policies for the retention of administrative records. A comparison group could not be identified for this group because of destruction of information on applicants who did not receive the Powe Award. The policy currently requires the retention of data for only 10 years. Past news releases, which are exempt from the 10 year retention rules, were used to obtain the names, university, field, and year of Powe awardees in the earliest years of the Award program.

Implications for Future Research

In future studies of Powe awardees, there are changes to the survey that could be implemented to improve the information gathered. First, the current study was limited to two academic years reporting publications and presentations. Extending the timeframe of reporting for publications and presentation would allow for deeper analysis of publication patterns over the career lifetime of Powe awardees. Differences in publication patterns within scientific disciplines are a difficult topic to track with the rise of interdisciplinary research (Levin & Stephan, 1991; Podlubny, 2005; Xu, 2008). Hopkins et al. (2013) studied the publication patterns based on race

and ethnicity. Both gender and race/ethnicity have significant underrepresentation in the main STEM university faculty population.

Future research could also benefit from the addition of demographic variables. Including differences in research and career outcomes by career age, scientific discipline, gender, race/ethnicity, and citizenship would complement the current study. The literature provides indications that gender plays a role in publication patterns, promotion, and tenure in the scientific and engineering disciplines (Xu, 2008; Ceci & Williams, 2011; Duch et al., 2012; Peterson, et al., 2012). The seminal work of Lehman (1953) showed the relationship between aging and research productivity, supported by major works from Levin and Stephan (1991, 1992) focused on the STEM disciplines. More recent papers extending these studies have been published by Gingras et al. (2008) and Jacob & Lefgren (2011) revealing sub-trends over the careers of researchers using the more advanced techniques of bibliometric studies and citation analysis.

On the current survey, eighty-five percent (85%) of Powe awardees reported earning grants of $10,000 or more to support their research programs. The total number of grants earn was 1,866 total grants from federal funding agencies, private sources, or respondents' institutions. Two hundred seventeen (217) survey respondents reported the largest grants received totaled just under $283 million. ORAU's direct investment in the Powe Awards was $5,000 per award for 460 Powe Awards or $2.3 million. With more data from awardees on the grants obtained, a return on investment calculation could be performed.

Finally, a future survey could change the questions pertaining to tenure obtainment. The current question asks respondents if they have ever received tenure. A future series of questions could expand this topic to capture if a respondent had ever been denied tenure, if they received

tenure at their original Powe university, if the respondent had tenure at their current university, and if tenure had been obtained as part of an offer for a new faculty appointment.

In addition to improving the survey instrument, future research to extend the current study could be accomplished with the inclusion of a "no treatment" comparison group of researchers who applied for, but did not receive a Powe Award. This inclusion would also increase the internal validity of the study (Shadish et al., 2002). A comparison group will help "disentangle the effects of selection bias – induced by the programmatic goal of supporting 'the best and the brightest' – from the effects of the awards" (Pion & Cordray, 2008, p. 338) to demonstrate the casual effectiveness of the Powe Award. Obvious counterfactuals are difficult to identify because those not selected for a Powe Award should differ from the awardees in terms of scientific merit. The other studies that employed comparison groups (National Research Council, 2006; Carney et al., 2008; Escobar, Alvarez & Myers, 2013; Mason et al., 2013) did so by identifying non-awardee applicants to the early career program especially those with similar score or behaviors. In the case of the NSF CAREER award (Carney et al., 2008), the comparison group included faculty members that had won other (non-CAREER) NSF grants in the same years as the CAREER awardees. Rosenbaum and Rubin (1984) proposed propensity score analysis as a way to match members of the treatment and comparison groups, and Dehejia and Wahba (2002) proposed using this analysis to show casual relationships. If the administrative records exist, using those just above the "cut" line for awardees and those just below the line should share similar characteristics and being close in score means statistical significance or effect size calculations can be used to determine casual impact of the Powe Award. In order to establish the comparison group, administrative records must be used.

Finally, future research could benefit from a form of verification of the research and career outcomes through the addition of additional data sources. While time consuming and costly (Dietz et al., 2000), the information that can be collected from the CVs of researchers can provide detailed information on publications, research grants, awards, and employment history. Verification of publications through a bibliometric analysis (Carney et al., 2008) can verify the true publication history of the awardees. These data sources combined with survey and/or interview data on the perceived impacts of the award can provide a more comprehensive view of the outcomes for Powe Award winners.

From the quantitative data gathered, there are clearly outliers in terms of productivity (numbers of publications, presentations, and research grants obtained). Additionally, there are Powe awardees that hold positions of leadership within universities and outside the university in the research community. A study of the outliers in terms of top achievers and also underachievers would help address the question of the role of the Powe Award in awardees' careers and research. In-depth interviews coupled with quantitative data could reveal how overachievers and underperformers responded differently to the pressures of academia, such as the pressure to "publish or perish" and raise external research funding through grants.

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Appendices

Appendix A

Table 18 - Powe Award winner population by year

Year	Number of Awardees	Number of Survey Respondents
1991	5	1
1992	11	1
1993	10	4
1994	10	7
1995	15	9
1996	16	9
1997	20	10
1998	24	10
1999	24	11
2000	24	15
2001	25	10
2002	24	14
2003	24	15
2004	25	15
2005	26	18
2006	25	10
2007	30	18
2008	30	22
2009	30	20
2010	32	21
2011	30	18
Total	457	258

Table 19 - Powe Awards 1991-2001 distribution by discipline

Discipline	Number of Powe Awards	Number of Survey Respondents
Engineering and Applied Sciences	172	99
Physical Science	123	71
Life Science	95	57
Mathematics and Computer Science	48	22
Policy, Management, and Education	22	9
Total	460	258

Table 20 - Distribution of Powe Awards 1991-2011 by ORAU member university

University of Powe Award	Number of Powe Awards	Number of Survey Respondents
North Carolina State University	19	9
Duke University	17	9
Louisiana State University	15	10
Virginia Polytechnic Institute and State University	15	6
University of Maryland	14	9
University of Florida	11	5
University of Tennessee	11	6
Clemson University	10	3
Mississippi State University	10	6
University of Missouri – Columbia	10	6
University of North Carolina at Charlotte	10	2
University of Pittsburgh	10	5
University of Arkansas	9	7
University of New Mexico	9	7
George Mason University	8	4
George Washington University	8	7
Rice University	8	6
University of Louisville	8	4
University of North Texas	8	3
Florida State University	7	5
Georgia Institute of Technology	7	6
Tennessee Technological University	7	5
Tulane University	7	2
University of Georgia	7	4

Table 20 (continued)

University of Powe Award	Number of Powe Awards	Number of Survey Respondents
University of Southern Mississippi	7	2
Washington University in St. Louis	7	6
East Carolina University	6	5
Idaho State University	6	2
Oklahoma State University	6	5
Southern Illinois University at Carbondale	6	3
Texas A&M University	6	3
University of Houston	6	1
University of Michigan	6	4
University of Oklahoma	6	4
West Virginia University	6	4
Auburn University	5	3
Georgetown University	5	3
University of Kentucky	5	5
University of Missouri – Rolla	5	4
University of Notre Dame	5	2
University of Texas at Austin	5	2
University of Virginia	5	4
Vanderbilt University	5	2
Emory University	4	3
Michigan Technological University	4	3
Southern Methodist University	4	3
University of Delaware	4	3
University of Mississippi	4	3
University of Mississippi Medical Center	4	3
University of South Florida	4	2

Table 20 (continued)

University of Powe Award	Number of Powe Awards	Number of Survey Respondents
Florida Institute of Technology	3	1
Indiana University	3	1
University of Alabama	3	2
University of Alabama at Birmingham	3	1
University of Arkansas for Medical Sciences	3	3
University of Charleston	3	1
University of Nevada at Las Vegas	3	3
University of South Alabama	3	1
Virginia Commonwealth University	3	1
Wake Forest University	3	2
Appalachian State University	2	1
Carnegie Mellon University	2	1
New Mexico State University	2	1
North Carolina A&T State University	2	1
Ohio State University	2	1
Pennsylvania State University	2	1
University of Alabama at Huntsville	2	-
University of Central Florida	2	1
University of Memphis	2	1
University of Miami	2	-
University of Nevada, Reno	2	2
University of South Carolina	2	-
University of Tennessee at Memphis	2	1
University of Tulsa	2	1
Western Kentucky University	2	2
Arkansas State University	1	-

Table 20 (continued)

University of Powe Award	Number of Powe Awards	Number of Survey Respondents
Clark Atlanta University	1	-
College of Charleston	1	1
College of William and Mary	1	1
East Tennessee State University	1	1
Florida Atlantic University	1	-
Florida International University	1	-
Johns Hopkins University	1	-
Michigan State University	1	1
Tennessee State University	1	-
Texas Christian University	1	-
University of Cincinnati	1	1
University of North Carolina	1	-
University of North Dakota	1	-
University of Puerto Rico	1	-
University of Tennessee at Chattanooga	1	1
University of Texas at Arlington	1	1
University of Texas at Dallas	1	1
Virginia State University	1	-
Total	460	258

Appendix B

Ralph E. Powe/ORAU Junior Faculty Awardees Survey

Study Informed Consent
You have been invited to participate in a research study funded by Oak Ridge Associated Universities. The purpose of this study is to study the career trajectories of past recipients of the Ralph E. Powe/ORAU Junior Faculty Awards. ORAU will use the findings to understand the career paths and outcomes of its recipients. The results will be presented to the ORAU member institutions as well as possibly for conference presentations, academic publications, and/or press releases.

INFORMATION ABOUT PARTICIPANTS' INVOLVEMENT IN THE STUDY
You are invited to participate because you are the winner of a Ralph E. Powe or ORAU Junior Faculty Award since its inception in 1991. As a participant in this study, you are being asked to respond to this survey regarding your academic career, such as positions held, papers published, patents granted, research grants awarded, tenure obtainment, and leadership positions held. Additionally, you will be asked about the influence the Powe/ORAU Junior Faculty Award may have had on some of these items.

CONFIDENTIALITY
Due to the fact that your name has been made public upon winning the Ralph E. Powe or ORAU Junior Faculty Awards, your name could be identified as a possible respondent to the survey. Thus, we cannot guarantee confidentiality.

RISKS
There are no foreseeable risks to you stemming from your participation in this research.

BENEFITS
Benefits of participation may include increased understanding on career trajectory of junior faculty grants and awards. This will help ORAU and its member institutions in addition to other institutions understand and promote junior faculty programs in the future.

CONTACT INFORMATION
This study is being conducted by Sam Held from the Oak Ridge Associated Universities. If you have questions at any time about the study or the procedures, you may contact the Mr. Held at either sam.held@orau.org or 865-576-8223. If you have questions about your rights as a participant, contact the Oak Ridge Sitewide Institutional Review Board at 865-576-1725.

PARTICIPATION
You are participation in this study is completely voluntary and you are free to discontinue participation at any time. Refusal to participate will not involve any penalty or loss of benefits to which you are otherwise entitled.

CONSENT
If you have read the above information and agree to participate in the study, please click on the Next button below to complete the survey.

[New Page]

Ralph E. Powe/ORAU Junior Faculty Awardees Survey

[Programming notes for online survey in brackets]

Employment – Academic and Non-Academic Positions
To begin this survey, we would like to learn about your professional experiences, including positions you have held and places you have worked.

1. Please describe your work experiences in the table below, beginning with your current or most recent position, and working backwards in time until you reach the first position held after finishing your education. Include postdoctoral fellowships. Please list all rank, title, or position changes separately, even if they occurred within the same institution.
   DEFINITIONS: An ***academic institution*** is one that grants degrees; a ***non-academic organization*** does not grant degrees. A ***tenure-track equivalent position*** is one for which: (1) your employing department/organization does not offer tenure; (2) you are engaged in research in an area of science, mathematics, engineering, or technology; (3) your appointment is a continuing appointment; (4) your appointment has substantial educational responsibilities.

	Rank or Title	Name of Institution/ Employer	Start Date (MM/YYYY)	End Date (MM/YYYY)	Type of position	Was this position Tenure-Track or its equivalent?
Current or most recent position:	[textbox]	[textbox]	[textbox]	[textbox]	[Dropdown menu]	[Dropdown menu]
First prior position:	[textbox]	[textbox]	[textbox]	[textbox]	[Dropdown menu]	[Dropdown menu]
Next prior position:	[textbox]	[textbox]	[textbox]	[textbox]	[Dropdown menu]	[Dropdown menu]

[Repeat Next prior position row seven more times.
Dropdown menu for "Type of position: Academic, Non-Academic, Postdoctoral
Dropdown menu for "Was this position tenure-track": Yes, No]

2. Are you currently employed in your current/most recent position?
   ☐ No ☐ Yes

Some of the questions in this survey may reference academic time periods (e.g., "the 2010-11 academic year"). For purposes of responding, please consider this time period as beginning on September 1st and ending on August 31st.

3. Are you now, or have you ever been, tenured?
   ☐ No ☐ Yes

[New Page]

Questions about obtaining tenure

4. What date did you first receive tenure?
   (Format the date as MM/YYYY.)

5. Approximately how much time elapsed between your acceptance of a tenure-track faculty position and receipt of tenure?
   Years:
   Months:

6. People sometimes stop their "tenure clock" for personal reasons (e.g., child care, family, medical). Between the time that you received your most recent highest degree and now, did you ever stop your tenure clock for a period of time longer than 1 month?
   ☐ No ☐ Yes

[New Page – Skip Pattern: Go to Tenure Leave Periods if Yes, go to Questions on current position if No]

Tenure leave periods

7. Please fill in the dates of any leaves during which you stopped your tenure clock:
   (Please enter the dates in the format of MM/YYYY.)

	Start Date	End Date
Leave Period #1		
Leave Period #2		
Leave Period #3		
Leave Period #4		

[New Page]

Questions on current position

The next few questions ask about the experiences you have had in your current position over the 2010 - 2011 academic year.

8. Were you on sabbatical or other leave during the 2010-11 academic year?
   ☐ No ☐ Yes

9. Please allocate your total work time during the 2010-11 academic year into the following categories. These categories are not mutually exclusive (e.g., research may include teaching; preparing a course may be part of professional growth). Please allocate, as best you can, the percentage of your time spent in activities whose primary focus falls within the indicated categories.

If you were on sabbatical or other leave during the 2010-11 academic year, please base your responses for the next several questions on the most recent academic year during which you were not on leave.

Your responses should sum to 100 percent.

	Percent Time
Instruction with Undergraduate Students (including teaching; preparing courses; developing new curricula; advising or supervising students)	
Instruction with Graduate or First Professional Students (including teaching; preparing courses; developing new curricula; advising or supervising students; supervising clinical students)	
Research/Scholarship (including research; reviewing or preparing articles or books; attending or preparing for professional meetings or conferences; reviewing proposals; seeking outside funding; or giving speeches)	
Professional Growth (including taking courses; pursuing an advanced degree; other professional development activities; such as practice or activities to remain current in your field)	
Administration (including departmental, institution, or company-wide meetings)	
Service (including serving on academic committees; service to professional societies/associations; providing legal or medical services or psychological counseling to clients or patients; paid or unpaid community or public service)	
Other (Outside Consulting, Freelance Work, Other Outside Work / Other Non-Teaching Professional Activities that are not listed above)	

10. Did you engage in any of the following service or outreach activities during the last academic year (2010-11)?
    (Check all that apply)
    - ☐ Talked with elementary, middle, or high school students about my field or my research
    - ☐ Collaborated with elementary, middle, or high school teachers or staff on developing science, technology, engineering, or mathematics curricula or teacher preparation
    - ☐ Conducted research on how elementary, middle, or high school students learn science, mathematics, or engineering
    - ☐ Engaged local community college faculty or students in conversations or projects related to my field or my research
    - ☐ Developed a museum exhibit or event to foster public interest in science, technology, engineering, or mathematics
    - ☐ Testified or spoke before representatives of my local or state government about my field
    - ☐ Testified or spoke before representatives of the federal government about my field
    - ☐ None of the above

11. Please indicate your level of agreement with the following statements about your research and teaching on a 5-point scale from 1=Disagree to 5=Agree.

	Disagree	...	...	...	Agree
My teaching informs my research.	☐	☐	☐	☐	☐
My teaching informs my scientific knowledge.	☐	☐	☐	☐	☐
My research enhances my ability to teach graduate students.	☐	☐	☐	☐	☐
My research enhances my ability to teach undergraduate students.	☐	☐	☐	☐	☐

[New Page]

Educational Background

Next, we would like to ask you about your educational background.

12. In the table below, please describe each postsecondary degree you have received, indicating the degree type, year received, field(s), and institution name.
    If your university system has multiple campuses, please indicate from which campus you received your degree (e.g., University of Texas, Austin).

	Degree type	Year received	Degree field(s)	Institution name
First degree	[Dropdown menu]			
Second degree	[Dropdown menu]			
Third degree	[Dropdown menu]			
Fourth degree	[Dropdown menu]			
Fifth degree	[Dropdown menu]			
Sixth degree	[Dropdown menu]			

    [Dropdown Menu – AA/AS; AB; AM; BA/BS; D.Sc.; Ed.D.; JD; MA/MS; M.ED.; MD; MD/Ph.D.; Ph.D.; Other]

Thank you. Some items in this survey ask about "your most recent highest degree." If you earned two or more doctoral degrees (e.g., a Ph.D. and a J.D.), then your most recent highest degree is the doctoral degree you earned most recently. If you earned a doctoral degree and later a master's degree, your most recent highest degree is still your doctoral degree, since it is the highest degree you have earned.

13. During your most recent highest degree, did you receive any of the following?
    (Check all that apply.)
    - ☐ Teaching assistantship
    - ☐ Research assistantship that required work other than your own research
    - ☐ Graduate fellowship or traineeship from your graduate institution that did not require work in exchange
    - ☐ Nationally recognized graduate fellowship or traineeship from a government agency or private organization that you could use *at any institution of your choosing*
    - ☐ Fellowship to fund one or more years of graduate study abroad (e.g., Rhodes, Fulbright, Fulbright-Hays, Marshall, etc.)
    - ☐ An award recognizing your dissertation research
    - ☐ An award recognizing your teaching abilities
    - ☐ None of the above
    - ☐ Other, please specify:

[New Page]

Professional productivity and achievements

This section of the survey asks about your professional accomplishments. If questions are not applicable to you or your job requirements, just choose "No" to continue.

The first two questions ask you about your publications and presentations during the last **two** academic years.

14. Did you author any publications based on your own research during the last two academic years (2009-10 and 2010-11)?
    ☐ Yes ☐ No

15. Did you give any oral presentations based on your research during the last two academic years (2009-10 and 2010-11)?
    ☐ Yes ☐ No

[New Page]

Publications

16. Please indicate whether you authored or co-authored any publications during the last **two** academic years (2009-10 and 2010-11).
    Put 0 for publication types that do not apply.

	Number of publications:
Published or in press articles in peer-reviewed journals	
Articles submitted to peer-reviewed journals (under review)	
Chapters in edited volumes	
Edited volumes (as Editor or Co-Editor)	
Technical manuals or research monographs	
Textbooks	
Books other than textbooks based on your research	
Conference publications	
Oral Presentations	

17. Please indicate whether you gave any oral presentations based on your research during the last **two** academic years (2009-10 and 2010-11).
Put 0 for those that do not apply.

	Number of presentations given:
Invited presentations (keynote speaker, etc.) at national meetings of professional organizations	
Peer-reviewed presentations at national meetings of professional organizations	
Invited presentations at seminars, symposia, or other forums outside your institution	

[New Page]

Accomplishments

The next questions ask you about your accomplishments **since** receiving your most recent highest degree.

18. Have you ever been awarded or appointed to any of the following positions?
(Check all that apply.)
- ☐ Assistant directorship of a research center
- ☐ Directorship of a research center
- ☐ Endowed chair
- ☐ Endowed professor or appointment
- ☐ Joint appointment with a federally-funded research and development center (FFRDC)
- ☐ Summer faculty fellowship at a research organization or federal agency
- ☐ Visiting professorship at another institution
- ☐ None of the above

19. Have you ever served in an academic institution in one of the following administrative positions?
An academic institution is one that grants degrees; a non-academic organization does not grant degrees.
(Check all that apply.)
- ☐ Department Chair
- ☐ Assistant Dean or Assistant Provost
- ☐ Associate Dean or Associate Provost
- ☐ Dean or Provost
- ☐ Chancellor, Vice President or President
- ☐ None of the above

20. Have you ever started your own company or nonprofit agency based on your research or professional work?
    ☐ Yes
    ☐ No, but I am planning to start my own company
    ☐ No, I have not started my own company and I am not planning to

21. Have you ever received patents or copyrights, or developed any products for commercial sale or licensing, based on your research?
    ☐ No ☐ Yes

[New Page]

Intellectual Property

22. Please indicate the number of each patent or copyright, or any product developed for commercial sale or licensing below.

	Number of each:
Invention disclosures written:	
Patents or Copyrights applied for:	
Patents or Copyrights pending:	
Patents or Copyrights received:	
Products developed for commercial sale or license:	

[New Page]

Accomplishments (continued)

23. Have you ever served in the following capacities?
    (Check all that apply.)

    I have served on or as a…
    ☐ National Science Foundation review panel or committee
    ☐ Other federal government funding agency review panel or committee
    ☐ National Academy of Sciences review panel or committee
    ☐ Professional association committee
    ☐ Reviewer for a peer-reviewed journal
    ☐ Editor of a peer-reviewed journal
    ☐ Officer in a professional association or organization
    ☐ Chairperson of a university-wide committee (tenure, salary, curriculum, etc)
    ☐ Chairperson of a faculty search committee (hiring committee)
    ☐ Chairperson of a dissertation committee
    ☐ None of the above
24. Since receiving your highest degree, have you received any honorary recognitions or awards (not research grants) honoring your research?

☐ No ☐ Yes

[New Page]

Accomplishments (continued)

25. From which organizations did you receive honorary recognitions or awards (not research grants) honoring your research?
(Check all that apply)

☐ Environmental Protection Agency (EPA)
☐ National Aeronautics and Space Agency (NASA)
☐ National Institutes for Health (NIH)
☐ National Institute of Standards and Technology (NIST)
☐ National Oceanic and Atmospheric Administration (NOAA)
☐ National Science Foundation (NSF)
☐ U.S. Department of Defense (DOD)
☐ U.S. Department of Education (ED)
☐ U.S. Department of Energy (DOE)
☐ My institution/employer
☐ A local or regional professional association
☐ A national professional association
☐ A private foundation
☐ Local or state government
☐ Other, please specify:

[New Page]

Grants, Awards, and Honors

Thank you for your responses so far!

The next few questions ask about the grant funding you have received in support of your research. Please respond to the best of your memory – you do not need to look information up.

26. Since receiving your highest degree, approximately how many research grants worth **$10,000 or more** have you received to support your research? Please report number of grants received by funding source. Do not include graduate or postdoctoral awards.

	Number of grants
Environmental Protection Agency (EPA)	
National Aeronautics and Space Agency (NASA)	
National Institutes for Health (NIH)	
National Institute of Standards and Technology (NIST)	
National Oceanic and Atmospheric Administration (NOAA)	
National Science Foundation (NSF)	
U.S. Department of Defense (DOD)	
U.S. Department of Education (ED)	
U.S. Department of Energy (DOE)	
Other federal agencies	
My institution / employer	
A local or regional professional association	
A national professional association	
A private foundation	
Local or state government	

27. In the table below, please describe the largest research grant you have ever received (excluding graduate or postdoctoral awards).

	Name of Grant Program	Funding Organization	Approximate Total Amount	Year Awarded	Length of grant period
Grant					[Dropdown menu]
			1 – 35000000	1900 – 2100	

[Dropdown menu - < 1 year; 1 year - < 2 years; 2 years - < 3 years; 3 years - < 4 years; 4 years - < 5 years; 5 years - < 6 years; 6 or more years]

28. Did you initially receive the award you just described before or after receiving tenure?
☐ Before ☐ After

Pre-tenure grant

29. In the table below, please describe the largest research grant you received **prior to obtaining tenure**.

	Name of Grant Program	Funding Organization	Approximate Total Amount	Year Awarded	Length of grant period
My largest pre-tenure grant was/is:					[Dropdown menu]
			1 – 35000000	1900 – 2100	

[Dropdown menu - < 1 year; 1 year - < 2 years; 2 years - < 3 years; 3 years - < 4 years; 4 years - < 5 years; 5 years - < 6 years; 6 or more years]

[New Page]

Your Ralph E. Powe/ORAU Junior Faculty Award

Finally, we would like to ask you several questions about the grant you received from the Ralph E. Powe/ORAU Junior Faculty Award Program at Oak Ridge Associated Universities, including your grant activities, the grant's impact on your own professional development, and your reasons for applying to the Ralph E. Powe/ORAU Junior Faculty Award program.

We will refer to this grant as your "Powe award."

30. Is your Powe award still active or has the grant period ended?
    ☐ Still active ☐ Grant period has ended

31. How are you using or did you use your Powe award funds?
    (Check all that apply.)
    ☐ Summer salary for myself
    ☐ Equipment or instruments
    ☐ Supplies
    ☐ Support of graduate students to collaborate on my research
    ☐ Support of undergraduate students to collaborate on my research
    ☐ Recruitment of human participants/acquisition of animal subjects
    ☐ Release from teaching one or more courses
    ☐ Travel for a field-based component of my research
    ☐ Travel to disseminate my research findings
    ☐ Travel to acquire new knowledge or skills
    ☐ Travel to engage in educational or outreach activities
    ☐ Curricular reform activities in my field
    ☐ Development of a new course or course module
    ☐ Other educational activities
    ☐ None of the above
    ☐ Other, please specify:

[New Page]

Graduate students supported

32. How many graduate students were supported or are currently supported on your Powe award?
(Enter 0 if no graduate students were or are supported by your Powe award.)

[New Page]

Undergraduate students supported

33. How many undergraduate students were supported or are currently supported on your Powe award?
(Enter 0 if no undergraduate students were or are supported by your Powe award.)

[New Page]

Your Powe award (continued)

34. Since winning your Powe award, have you applied for other grant funding?
☐ No ☐ Yes

35. What initially influenced your decision to apply for the Powe award?
(Check all that apply.)

☐ Getting a Powe or early career award was required for my tenure review
☐ Getting a Powe or early career award would be a significant factor in my tenure review
☐ I thought Powe award was the most prestigious grant for which I was eligible
☐ A senior colleague encouraged me to apply for a Powe award
☐ All assistant professors in my department were expected to apply for an early career award
☐ I felt that I was more competitive in a grant program targeting junior faculty
☐ Other grants had more burdensome application and/or reporting requirements
☐ Other factors not listed above
☐ I do not remember

36. Reflecting on your Powe award, which of the following (if any) benefits did you derive from your Powe award?
(Check all that apply.)
☐ Support for research prior to a tenure decision
☐ An opportunity to move to a more prestigious institution
☐ An opportunity to apply for an additional early career award
☐ An opportunity to form a partnership with industry

- ☐ An opportunity to leverage other funds to support my research
- ☐ An opportunity to pursue an educational activity that subsequently benefited my research
- ☐ Additional time because I did not need to spend time applying for other grants prior to tenure
- ☐ Engagement in a new kind of research that I would not have otherwise been able to pursue
- ☐ In some other way(s), fostered my research productivity
- ☐ In some other way(s), enabled me to pursue educational activities
- ☐ None of the above

37. Was the dollar amount you received as your Powe award adequate to implement the activities you proposed?
    ☐ No ☐ Yes ☐ I don't remember

38. In what ways, if any, have you sustained the research activities you implemented as part of your Powe award?

Powe Award and tenure decisions

The following questions concern tenure and the role of your Powe award in the tenure process.

39. Did your Powe award influence your receipt of tenure in any of the following ways? (Check all that apply.)
    - ☐ my department values the prestige of the award
    - ☐ my department values my ability to bring in external grant funding
    - ☐ the award supported my research, which my department values
    - ☐ the award supported my educational activities, which my department values
    - ☐ the award helped in some other way not listed here
    - ☐ the award did not help in any of these ways
    - ☐ I don’t know what role the award played in the tenure decision

40. Did your Powe grant hinder your receipt of tenure in any of the following ways? (Check all that apply.)
    Because of this grant…
    ☐ I spent too much time on teaching or educational activities
    ☐ I spent too much time on outreach activities away from my home institution
    ☐ I did not apply for additional grants, which hindered my tenure case
    ☐ I did not have sufficient funding to allow me to complete enough research
    ☐ I was hindered in some other way not listed here
    ☐ I spent too much time administering the grant
    ☐ This grant did not hinder my receipt of tenure
    ☐ I don't know what role the grant played in the tenure decision

41. Did your department chairperson or a member of your tenure review committee specifically mention that the Powe award was a positive factor in the decision to recommend you for tenure?
    ☐ No ☐ Yes ☐ I don't remember

42. Please describe in your own words what your Powe award has meant for your professional development. Please include positive as well as negative impacts, if any.

43. If there is anything else you would like to tell us about you or this survey, please use the space below.

44. Can the ORAU researcher conducting this survey contact you for a short follow-up interview? If so, please enter your e-mail address to best contact you in the space below.
    ☐ Yes, my e-mail address is:
    ☐ No

Thank you very much for completing this survey! The information you have provided will inform our understanding of career paths of Powe awardees, and provide information to help ORAU better manage its programs.

Your survey is now complete. All of the information you have provided will be maintained in a confidential fashion and will only be reported in aggregate fashion.

On behalf of Oak Ridge Associated Universities, thank you very much for your time and cooperation!

Appendix C

Table 21 - Peer-reviewed publications from Powe Awardees at research intensive institutions

Powe Award year	Number of respondents	Sum of publications	Minimum number of publications	Maximum number of publications	Mean number of publications	Standard deviation of publications	Median number of publications
1991	1	8	8	8	8.0	0.0	8
1992	1	25	25	25	25.0	0.0	25
1993	2	11	1	10	5.5	4.5	5.5
1994	2	3	0	3	1.5	1.5	1.5
1995	6	31	0	15	5.2	5.4	3.5
1996	5	35	1	16	7.0	5.3	6
1997	6	16	0	4	2.7	1.6	3.5
1998	4	57	6	20	14.3	5.4	15.5
1999	7	88	0	43	12.6	15.0	4
2000	11	111	1	25	10.1	7.1	9
2001	7	119	0	60	17.0	19.9	8
2002	11	173	2	40	15.7	12.7	14
2003	9	96	0	38	10.7	11.5	5

Table 21 (continued)

Powe Award year	Number of respondents	Sum of publications	Minimum number of publications	Maximum number of publications	Mean number of publications	Standard deviation of publications	Median number of publications
2004	11	74	0	15	6.7	5.6	6
2005	16	181	4	25	11.3	6.3	9
2006	10	83	0	30	8.3	8.2	6.5
2007	16	130	0	18	8.1	6.1	7
2008	21	176	3	22	8.4	4.4	8
2009	19	117	0	20	6.2	5.1	6
2010	19	115	2	12	6.1	3.4	5
2011	16	109	0	31	6.8	8.5	4.5
Total	200	1758	0	60	8.8	8.8	6

Table 22 - Peer-reviewed publications from Powe Awardees at Non-research Intensive Institutions

Powe Award year	Number of respondents	Sum of publications	Minimum number of publications	Maximum number of publications	Mean number of publications	Standard deviation of publications	Median number of publications
1991	-	-	-	-	-	-	-
1992	-	-	-	-	-	-	-
1993	1	6	6	6	6.0	0.0	6
1994	4	13	0	10	3.3	4.1	1.5
1995	3	18	0	18	6.0	8.5	0
1996	4	65	2	45	16.3	17.0	9
1997	3	10	1	5	3.3	1.7	4
1998	6	54	0	29	9.0	9.7	6
1999	4	29	0	19	7.3	7.2	5
2000	3	36	7	19	12.0	5.1	10
2001	3	32	3	20	10.7	7.0	9
2002	1	15	15	15	15.0	0.0	15
2003	5	56	0	24	11.2	7.7	10
2004	4	19	0	10	4.8	3.7	4.5

Table 22 (continued)

Powe Award year	Number of respondents	Sum of publications	Minimum number of publications	Maximum number of publications	Mean number of publications	Standard deviation of publications	Median number of publications
2005	1	5	5	5	5.0	0.0	5
2006	-	-	-	-	-	-	-
2007	2	24	6	18	12.0	6.0	12
2008	1	2	2	2	2.0	0.0	2
2009	1	15	15	15	15.0	0.0	15
2010	-	-	-	-	-	-	-
2011	1	10	10	10	10.0	0.0	10
Total	47	409	0	45	8.7	8.8	6

Table 23 - Presentations from Powe Awardees at Research Intensive Institutions

Powe Award year	Number of respondents	Number of presentations	Minimum number of presentations	Maximum number of presentations	Mean number of presentations	Standard deviation of presentations	Median number of presentations
1991	1	3	3	3	3.0	0.0	3
1992	1	10	10	10	10.0	0.0	10
1993	2	7	1	6	3.5	2.5	3.5
1994	2	5	0	5	2.5	2.5	2.5
1995	6	47	0	19	7.8	6.1	6
1996	5	31	0	20	6.2	7.2	4
1997	6	6	0	4	1.0	1.4	0.5
1998	4	53	5	23	13.3	7.5	12.5
1999	7	77	0	33	11.0	10.9	8
2000	11	111	1	34	10.1	8.7	10
2001	7	221	3	152	31.6	49.9	8
2002	11	145	0	28	13.2	8.0	14
2003	9	142	1	40	15.8	12.8	10
2004	11	98	0	32	8.9	9.0	6

Table 23 (continued)

Powe Award year	Number of respondents	Number of presentations	Minimum number of presentations	Maximum number of presentations	Mean number of presentations	Standard deviation of presentations	Median number of presentations
2005	16	260	0	45	16.3	12.3	11.5
2006	10	148	0	39	14.8	12.4	10
2007	16	232	0	45	14.5	14.5	9
2008	21	361	0	57	17.2	15.6	14
2009	19	158	0	24	8.3	6.9	6
2010	19	178	0	25	9.4	7.4	8
2011	16	135	0	26	8.4	6.8	7.5
Total	200	2428	0	152	12.1	14.8	8

Table 24 - Presentations from Powe Awardees at Non-research Intensive Institutions

Powe Award year	Number of respondents	Number of presentations	Minimum number of presentations	Maximum number of presentations	Mean number of presentations	Standard deviation of presentations	Median number of presentations
1991	-	-	-	-	-	-	-
1992	-	-	-	-	-	-	-
1993	1	21	21	21	21.0	0.0	21
1994	4	27	0	25	6.8	10.6	1
1995	3	29	0	29	9.7	13.7	0
1996	4	26	2	17	6.5	6.2	3.5
1997	3	23	2	15	7.7	5.4	6
1998	6	84	1	31	14.0	10.3	15
1999	4	66	0	37	16.5	13.8	14.5
2000	3	28	6	12	9.3	2.5	10
2001	3	61	8	40	20.3	14.1	13
2002	1	11	11	11	11.0	0.0	11
2003	5	70	2	34	14.0	10.9	11

Table 24 (continued)

Powe Award year	Number of respondents	Number of presentations	Minimum number of presentations	Maximum number of presentations	Mean number of presentations	Standard deviation of presentations	Median number of presentations
2004	4	42	5	15	10.5	4.6	11
2005	1	10	10	10	10.0	0.0	10
2006	-	-	-	-	-	-	-
2007	2	34	17	17	17.0	0.0	17
2008	1	1	1	1	1.0	0.0	1
2009	1	6	6	6	6.0	0.0	6
2010	-	-	-	-	-	-	-
2011	1	4	4	4	4.0	0.0	4
Total	47	543	0	40	11.6	10.3	10

Table 25 – Peer Reviewed and Non-peer Reviewed Articles from Powe Awardees at Research Intensive Institutions

Powe Award Year	Number of Respondents	Published or in press articles in peer-reviewed journals	Articles submitted to peer-reviewed journals (under review)	Published or in press articles in non-peer-reviewed journals	Technical manuals or research monographs	Conference Publications
1991	1	8	4	0	0	6
1992	1	25	2	0	0	15
1993	1	6	2	0	0	0
1994	2	13	7	5	1	20
1995	6	44	20	0	0	9
1996	5	74	18	0	0	25
1997	6	14	8	0	0	4
1998	4	57	5	0	0	23
1999	7	59	9	5	0	5
2000	11	111	29	2	0	43
2001	7	123	14	13	1	20
2002	11	167	39	4	0	49
2003	9	104	24	1	2	32
2004	11	54	13	1	0	64
2005	16	166	35	1	0	116

Table 25 (continued)

Powe Award Year	Number of Respondents	Published or in press articles in peer-reviewed journals	Articles submitted to peer-reviewed journals (under review)	Published or in press articles in non-peer-reviewed journals	Technical manuals or research monographs	Conference Publications
2006	9	53	11	8	0	41
2007	16	134	28	3	0	68
2008	21	170	43	1	0	96
2009	19	126	36	8	3	63
2010	19	101	39	4	3	60
2011	16	109	31	3	0	50
Total	198	1,718	417	59	10	809

Table 26 - Peer Reviewed and Non-peer Reviewed Books and Book Chapters from Powe Awardees at Research Intensive Institutions

Powe Award Year	Number of Respondents	Chapters in edited volumes	Edited volumes (as Editor or Co-Editor)	Textbooks	Books other than textbooks based on your research
1991	1	0	0	0	0
1992	1	0	0	0	0
1993	1	2	0	0	0
1994	2	4	2	0	0
1995	6	0	1	0	0
1996	5	4	0	0	0
1997	6	2	0	0	1
1998	4	2	1	0	1
1999	7	10	1	0	1
2000	11	4	0	0	0
2001	7	5	2	0	0
2002	11	7	2	0	0
2003	9	8	2	0	0
2004	11	4	3	1	1
2005	16	12	2	1	0

Table 26 (continued)

Powe Award Year	Number of Respondents	Chapters in edited volumes	Edited volumes (as Editor or Co-Editor)	Textbooks	Books other than textbooks based on your research
2006	9	2	4	0	0
2007	16	10	8	0	0
2008	21	6	3	0	0
2009	19	7	2	0	1
2010	19	11	12	1	1
2011	16	17	1	1	0
Total	198	117	46	4	6

Table 27 - Peer Reviewed and Non-peer Reviewed Articles from Powe Awardees at Non-research Intensive Institutions

Powe Award Year	Number of Respondents	Published or in press articles in peer-reviewed journals	Articles submitted to peer-reviewed journals (under review)	Published or in press articles in non-peer-reviewed journals	Technical manuals or research monographs	Conference Publications
1991	-	-	-	-	-	-
1992	-	-	-	-	-	-
1993	1	1	3	0	0	1
1994	4	0	0	0	0	0
1995	3	5	2	0	0	18
1996	4	26	8	1	0	20
1997	3	11	3	3	0	1
1998	6	54	11	0	1	5
1999	4	58	0	0	0	0
2000	3	26	3	0	6	24
2001	3	28	9	0	0	8
2002	1	2	0	0	0	0
2003	5	24	4	0	0	23

Table 27 (continued)

Powe Award Year	Number of Respondents	Published or in press articles in peer-reviewed journals	Articles submitted to peer-reviewed journals (under review)	Published or in press articles in non-peer-reviewed journals	Technical manuals or research monographs	Conference Publications
2004	4	39	4	0	0	18
2005	1	6	3	0	0	10
2006	-	-	-	-	-	-
2007	2	20	4	0	0	4
2008	1	8	8	0	0	0
2009	1	6	4	0	0	0
2010	-	-	-	-	-	-
2011	1	10	1	0	1	0
Total	47	324	67	4	8	132

Table 28 - Peer Rreviewed and Non-peer Reviewed Books and Book Chapters from Powe Awardees at Non-research Intensive Institutions

Powe Award Year	Number of Respondents	Chapters in edited volumes	Edited volumes (as Editor or Co-Editor)	Textbooks	Books other than textbooks based on your research
1991	-	-	-	-	-
1992	-	-	-	-	-
1993	1	0	0	0	0
1994	4	0	0	0	0
1995	3	0	0	0	0
1996	4	4	0	0	1
1997	3	0	0	1	0
1998	6	2	0	0	1
1999	4	0	0	0	0
2000	3	4	0	0	1
2001	3	1	0	0	0
2002	1	0	0	0	0
2003	5	1	0	0	0
2004	4	2	1	0	0
2005	1	3	0	0	0

Table 28 (continued)

Powe Award Year	Number of Respondents	Chapters in edited volumes	Edited volumes (as Editor or Co-Editor)	Textbooks	Books other than textbooks based on your research
2006	-	-	-	-	-
2007	2	1	0	1	0
2008	1	2	0	0	0
2009	1	0	0	0	0
2010	-	-	-	-	-
2011	1	0	0	0	0
Total	47	20	0	2	3

Table 29 - Research Grant Obtainment from Survey Respondents at Research Intensive Institutions

Powe Award year	Number of respondents	Sum of total grants obtained	Minimum number of total grants obtained	Maximum number of total grants obtained	Mean number of total grants obtained	Standard deviation of total grants obtained	Median number of total grants obtained
1991	1	0	16	16	16.0	0.0	16
1992	1	27	27	27	27.0	0.0	27
1993	2	8	1	7	4.0	3.0	4
1994	2	15	0	15	7.5	7.5	7.5
1995	6	84	0	19	14.0	6.5	16.5
1996	5	52	2	18	10.4	6.2	9
1997	6	33	3	9	5.5	2.6	5
1998	4	53	8	19	13.3	4.1	13
1999	7	99	0	45	14.1	14.3	11
2000	11	120	0	23	10.9	6.7	9
2001	7	68	0	16	9.7	5.1	11
2002	11	110	0	23	10.0	8.1	7

Table 29 (continued)

Powe Award year	Number of respondents	Sum of total grants obtained	Minimum number of total grants obtained	Maximum number of total grants obtained	Mean number of total grants obtained	Standard deviation of total grants obtained	Median number of total grants obtained
2003	9	100	0	31	11.1	9.9	11
2004	11	70	0	12	6.4	4.2	6
2005	16	120	0	18	7.5	5.5	6
2006	9	58	2	11	6.4	3.3	6
2007	16	78	0	13	4.9	4.3	4
2008	21	126	1	18	6.0	4.2	5
2009	19	80	0	14	4.2	3.6	4
2010	19	78	1	10	4.1	2.7	3
2011	16	37	0	7	2.3	2.2	2
Total	199	1416	0	35	9.6	7.7	8

Table 30 - Research Grant Obtainment from Survey Respondents at Non-research Intensive Institutions

Powe Award year	Number of respondents	Sum of total grants obtained	Minimum number of total grants obtained	Maximum number of total grants obtained	Mean number of total grants obtained	Standard deviation of total grants obtained	Median number of total grants obtained
1991	-	-	-	-	-	-	-
1992	-	-	-	-	-	-	-
1993	1	10	10	10	10.0	0.0	10
1994	4	52	0	35	13.0	13.2	8.5
1995	3	55	11	24	18.3	5.4	20
1996	4	62	7	19	15.5	5.0	18
1997	3	26	5	12	8.7	2.9	9
1998	6	77	4	24	12.8	6.2	13.5
1999	4	20	0	13	5.0	5.4	3.5
2000	3	26	0	22	8.7	9.6	4
2001	3	17	0	11	5.7	4.5	6
2002	1	17	17	17	17.0	0.0	17

Table 30 (continued)

Powe Award year	Number of respondents	Sum of total grants obtained	Minimum number of total grants obtained	Maximum number of total grants obtained	Mean number of total grants obtained	Standard deviation of total grants obtained	Median number of total grants obtained
2003	5	21	0	9	4.2	4.1	3
2004	4	34	3	19	8.5	6.2	6
2005	1	9	9	9	9.0	0.0	9
2006	-	-	-	-	-	-	-
2007	2	13	6	7	6.5	0.5	6.5
2008	1	1	1	1	1.0	0.0	1
2009	1	3	3	3	3.0	0.0	3
2010	-	-	-	-	-	-	-
2011	1	7	7	7	7.0	0.0	7
Total	47	450	0	45	7.2	6.7	6

Table 31 – Sources of Research Grants from Survey Respondents at Research Intensive Institutions

Powe Award year	Number of grants from EPA	Number of grants from NASA	Number of grants from NIH	Number of grants from NIST	Number of grants from NOAA	Number of grants from NSF	Number of grants from DOD	Number of grants from DoEd	Number of grants from DOE
1991	0	0	0	0	0	1	0	0	0
1992	12	0	0	0	0	7	0	0	0
1993	0	0	0	0	0	7	0	0	0
1994	5	0	0	0	0	2	0	0	3
1995	0	0	0	1	0	54	8	0	6
1996	2	2	0	0	0	13	22	0	3
1997	4	0	3	0	0	5	0	0	0
1998	0	1	19	1	0	6	5	0	0
1999	1	3	6	2	4	36	7	0	3
2000	0	4	5	7	0	23	29	0	11
2001	0	8	5	0	0	13	13	0	8
2002	0	1	15	0	0	34	30	0	5
2003	0	1	11	0	0	18	28	0	17

Table 31 (continued)

Powe Award year	Number of grants from EPA	Number of grants from NASA	Number of grants from NIH	Number of grants from NIST	Number of grants from NOAA	Number of grants from NSF	Number of grants from DOD	Number of grants from DoEd	Number of grants from DOE
2004	0	4	5	0	0	17	6	0	6
2005	3	0	8	0	1	37	6	0	9
2006	1	1	2	0	0	11	9	0	6
2007	0	1	8	0	0	22	9	2	2
2008	3	5	12	0	0	27	10	0	7
2009	0	9	5	0	0	20	0	0	1
2010	1	4	4	1	3	23	5	0	7
2011	5	1	2	0	0	7	1	0	1
Total	37	45	110	12	8	383	188	2	95

Table 31 (continued)

Powe Award year	Number of grants from Other federal agencies	Number of grants from My institution/ employer	Number of grants from local or regional professional association	Number of grants from a national professional association	Number of grants from a private foundation	Number of grants from local/state government
1991	10	0	0	0	0	5
1992	0	0	0	0	8	0
1993	1	0	0	0	0	0
1994	5	0	0	0	0	0
1995	4	10	0	0	1	0
1996	1	8	0	0	1	0
1997	6	7	2	2	3	1
1998	3	5	1	1	8	3
1999	2	19	0	0	1	15
2000	17	10	0	2	7	5
2001	6	6	0	4	3	2
2002	4	2	1	1	16	1

Table 31 (continued)

Powe Award year	Number of grants from Other federal agencies	Number of grants from My institution/ employer	Number of grants from local or regional professional association	Number of grants from a national professional association	Number of grants from a private foundation	Number of grants from local/state government
2003	0	18	0	1	6	0
2004	0	13	1	4	11	3
2005	3	21	2	5	9	16
2006	2	13	3	0	2	8
2007	5	17	0	3	7	2
2008	14	17	6	1	13	11
2009	7	20	4	2	9	3
2010	2	17	0	1	4	6
2011	1	11	3	0	3	2
Total	93	214	23	27	112	83

Table 32 – Sources of Research Grants from Survey Respondents at Non-research Intensive Institutions

Powe Award year	Number of grants from EPA	Number of grants from NASA	Number of grants from NIH	Number of grants from NIST	Number of grants from NOAA	Number of grants from NSF	Number of grants from DOD	Number of grants from DoEd	Number of grants from DOE
1991	-	-	-	-	-	-	-	-	-
1992	-	-	-	-	-	-	-	-	-
1993	0	0	0	0	0	5	2	0	0
1994	0	10	0	0	0	18	5	0	5
1995	0	0	1	0	0	11	0	0	8
1996	0	4	7	0	0	18	8	0	2
1997	0	0	0	0	0	7	5	0	12
1998	1	1	13	0	0	16	9	1	6
1999	1	0	0	0	0	9	0	0	0
2000	0	0	0	0	0	4	5	0	0
2001	0	0	3	0	0	6	0	0	3
2002	0	0	3	0	0	4	1	0	3
2003	0	0	0	0	0	11	1	0	0

Table 32 (continued)

Powe Award year	Number of grants from EPA	Number of grants from NASA	Number of grants from NIH	Number of grants from NIST	Number of grants from NOAA	Number of grants from NSF	Number of grants from DOD	Number of grants from DoEd	Number of grants from DOE
2004	0	0	2	0	0	17	0	0	3
2005	0	0	0	0	1	5	0	0	0
2006	-	-	-	-	-	-	-	-	-
2007	0	0	1	0	0	3	1	0	0
2008	0	0	0	0	0	1	0	0	0
2009	0	0	1	0	0	2	0	0	0
2010	-	-	-	-	-	-	-	-	-
2011	0	0	0	0	0	1	0	0	2
Total	2	15	31	0	1	138	37	1	44

Table 32 (continued)

Powe Award year	Number of grants from Other federal agencies	Number of grants from My institution/ employer	Number of grants from local or regional professional association	Number of grants from a national professional association	Number of grants from a private foundation	Number of grants from local/state government
1991	-	-	-	-	-	-
1992	-	-	-	-	-	-
1993	1	2	0	0	0	0
1994	11	0	0	0	3	0
1995	3	23	0	1	3	5
1996	0	4	0	0	11	8
1997	0	1	0	0	0	1
1998	7	8	0	2	11	2
1999	0	4	0	0	4	2
2000	3	1	0	0	6	7
2001	0	4	0	0	1	0
2002	0	0	0	0	6	0
2003	1	6	0	1	1	0

Table 32 (continued)

Powe Award year	Number of grants from Other federal agencies	Number of grants from My institution/ employer	Number of grants from local or regional professional association	Number of grants from a national professional association	Number of grants from a private foundation	Number of grants from local/state government
2004	0	6	0	0	1	5
2005	2	1	0	0	0	0
2006	-	-	-	-	-	-
2007	0	4	0	0	3	1
2008	0	0	0	0	0	0
2009	0	0	0	0	0	0
2010	-	-	-	-	-	-
2011	0	3	0	0	1	0
Total	28	67	0	4	51	31

Table 33 - Sources of Honorary Awards Recognizing the Powe Awardees

Powe Award year	Number of respondents	EPA	NASA	NIH	NIST	NOAA	NSF	DOD	DoEd	DOE
1991	1	0	0	0	0	0	0	0	0	0
1992	1	0	0	0	0	0	1	0	0	1
1993	4	0	0	0	0	0	1	0	0	0
1994	7	0	1	0	0	0	0	0	0	0
1995	9	0	0	1	0	0	2	0	0	1
1996	9	0	0	0	0	0	0	0	0	0
1997	10	0	0	0	0	0	0	0	0	0
1998	10	0	0	1	0	0	3	0	0	1
1999	11	0	0	0	0	0	0	0	0	0
2000	15	0	0	0	0	0	0	0	0	0
2001	10	0	0	0	0	0	1	0	0	0
2002	14	0	0	0	0	0	1	1	0	0
2003	15	0	0	0	0	0	2	0	0	0
2004	15	0	0	0	0	0	0	0	0	0

Table 33 (continued)

Powe Award year	Number of respondents	EPA	NASA	NIH	NIST	NOAA	NSF	DOD	DoEd	DOE
2005	18	0	0	0	0	0	2	0	0	0
2006	4	0	0	0	0	0	0	0	0	0
2007	10	0	0	0	0	0	3	0	0	0
2008	6	0	0	0	0	0	0	0	0	1
2009	9	0	0	1	0	0	1	0	0	1
2010	6	0	0	0	0	0	1	0	0	0
2011	4	1	0	1	0	0	2	0	0	0
Total	114	1	1	4	0	0	20	1	0	5

Table 33 (continued)

Powe Award year	Number of respondents	My institution/ employer	A local/ regional professional association	A national professional association	A private foundation	Local/ State Government	Other
1991	1	0	0	0	0	0	0
1992	1	0	0	1	0	0	0
1993	4	3	2	1	0	0	0
1994	7	1	0	1	0	1	0
1995	9	5	0	4	1	0	2
1996	9	3	2	3	1	0	1
1997	10	1	0	1	1	0	2
1998	10	7	2	3	2	0	1
1999	11	2	0	1	0	0	3
2000	15	3	1	2	0	1	3
2001	10	5	0	4	1	0	1
2002	14	4	1	2	2	1	1
2003	15	4	2	4	0	1	4

Table 33 (continued)

Powe Award year	Number of respondents	My institution/ employer	A local/ regional professional association	A national professional association	A private foundation	Local/ State Government	Other
2004	15	5	1	4	3	1	0
2005	18	4	1	4	1	2	3
2006	4	3	0	1	0	0	2
2007	10	4	0	2	4	0	3
2008	6	3	0	1	0	1	0
2009	9	1	1	3	2	1	2
2010	6	2	1	1	0	0	2
2011	4	1	0	1	1	0	1
Total	114	61	14	44	19	9	31

Table 34 – Leadership Positions within University Departments Reported by Powe Awardees

Powe Award year	Number of respondents	Chairperson of dissertation committee	Chairperson of a faculty search committee (hiring)	Chairperson of a university-wide committee (tenure)	Department chair	Visiting professor at another institution	Summer faculty fellowship at a research organization	Joint appointment with a federally-funded research center	Endowed professor or appointment	Endowed chair
1991	1	1	0	0	0	1	0	0	0	0
1992	1	1	1	0	1	1	0	0	0	0
1993	4	4	1	2	1	1	0	0	1	0
1994	7	3	2	2	1	1	1	1	2	0
1995	9	8	6	3	3	4	2	0	1	2
1996	9	8	7	4	1	2	1	0	2	1
1997	10	7	2	2	0	3	1	0	0	0
1998	10	7	7	4	2	5	0	1	1	2
1999	11	7	4	2	2	6	1	0	0	3
2000	15	12	8	7	3	6	0	0	2	4
2001	10	7	4	2	0	4	2	0	0	0
2002	14	8	4	6	1	7	1	0	3	0

Table 34 (continued)

Powe Award year	Number of respondents	Chairperson of dissertation committee	Chairperson of a faculty search committee (hiring)	Chairperson of a university-wide committee (tenure)	Department chair	Visiting professor at another institution	Summer faculty fellowship at a research organization	Joint appointment with a federally-funded research center	Endowed professor or appointment	Endowed chair
2003	15	10	5	4	1	4	0	0	2	1
2004	15	8	4	0	1	5	0	0	1	1
2005	18	13	5	1	0	2	2	1	1	1
2006	10	5	2	0	0	3	1	0	0	0
2007	18	9	2	1	0	2	2	0	1	0
2008	22	10	3	3	0	2	2	0	1	0
2009	20	7	4	1	0	0	1	0	1	1
2010	21	6	1	0	0	0	0	0	0	0
2011	18	4	0	1	0	2	1	0	0	0
Total	258	145	72	45	17	61	18	3	19	16

Table 35 - Leadership Positions at the University Level Reported by Powe Awardees

Powe Award year	Number of respondents	Assistant Dean or Assistant Provost	Associate Dean or Associate Provost	Dean or Provost	Chancellor, Vice President, or President	Assistant directorship of research center	Directorship of research center
1991	1	0	0	0	0	0	0
1992	1	0	0	0	0	0	0
1993	4	0	1	0	0	0	0
1994	7	0	1	1	1	0	2
1995	9	0	1	1	0	3	0
1996	9	0	0	0	0	1	1
1997	10	0	0	0	0	0	1
1998	10	0	0	0	0	0	2
1999	11	0	0	0	0	1	3
2000	15	0	0	0	0	0	4
2001	10	0	0	0	0	0	1
2002	14	0	0	0	0	3	0
2003	15	0	0	0	0	2	0
2004	15	0	0	0	0	0	1

Table 35 (continued)

Powe Award year	Number of respondents	Assistant Dean or Assistant Provost	Associate Dean or Associate Provost	Dean or Provost	Chancellor, Vice President, or President	Assistant directorship of research center	Directorship of research center
2005	18	0	0	0	0	2	0
2006	10	0	0	0	0	0	0
2007	18	0	0	0	0	0	0
2008	22	0	0	0	0	0	0
2009	20	0	0	0	0	1	0
2010	21	0	0	0	0	1	0
2011	18	0	0	0	0	0	0
Total	258	0	3	2	1	14	15

Table 36 - Leadership Positions within the Greater Research Community Reported by Powe Awardees

Powe Award year	Number of respondents	National Science Foundation review panel or committee	Other federal government funding agency review panel	National Academy of Sciences review panel or committee	Professional association committee	Reviewer for a peer-reviewed journal	Editor of a peer-reviewed journal	Officer in a professional association or organization
1991	1	1	0	1	1	1	0	1
1992	1	1	0	0	1	1	1	0
1993	4	4	3	0	3	4	1	2
1994	7	4	2	3	2	4	1	3
1995	9	7	4	1	4	8	3	4
1996	9	8	8	0	5	9	2	6
1997	10	6	4	0	4	9	2	4
1998	10	7	8	1	9	10	4	5
1999	11	8	7	0	5	9	5	5
2000	15	13	9	2	6	14	10	7
2001	10	7	6	0	3	10	5	3
2002	14	8	8	0	3	12	9	3

Table 36 (continued)

Powe Award year	Number of respondents	National Science Foundation review panel or committee	Other federal government funding agency review panel	National Academy of Sciences review panel or committee	Professional association committee	Reviewer for a peer-reviewed journal	Editor of a peer-reviewed journal	Officer in a professional association or organization
2003	15	12	9	0	8	15	5	6
2004	15	7	7	0	5	12	2	3
2005	18	14	10	1	4	17	4	6
2006	10	6	5	0	2	9	5	3
2007	18	12	7	2	8	16	8	6
2008	22	16	12	1	6	19	7	1
2009	20	13	7	0	6	16	3	1
2010	21	12	9	0	10	17	6	6
2011	18	4	8	0	3	14	2	2
Total	258	170	133	12	98	226	85	77

Vita

Sam Held received his B.S. degree in physics from the University of Rochester in 1996, M.S. degree in nuclear physics from the University of Tennessee in 1999, and M.S. degree in Secondary Science Education in 2000. Upon graduation from Tennessee, he taught mathematics for the Oak Ridge City Schools for two academic years. In 2002, Mr. Held joined the information technology department at the corporate headquarters of the large movie theatre chain, Regal Entertainment Group. In 2004, Mr. Held was hired as a program manager for science education and workforce programs by Oak Ridge Associated Universities (ORAU). Over his ten-year career, he also held the position of lead program evaluator, while rebuilding the assessment and evaluation capabilities of the Science Education Programs (SEP) business unit, and that of data manager of SEP, provided leadership in information architecture and data reporting for SEP's multiple federal and private clients. While at ORAU, Mr. Held served as the lead academic partner for the U.S. to the Lindau Meeting of Nobel Laureates. In 2014, Mr. Held joined Summit Consulting, LLC as a Senior Consultant specializing in program evaluation serving clients in the federal government and private entities. He has served in leadership positions of Government Evaluation and STEM Education and Training topical interest groups of the American Evaluation Association